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THE STEPPES

CONNECTING Europe and Asia like a broad grass-grown highway, the steppes of Russia have afforded the peoples of the great plateaus of inner Asia the avenue of escape from destitution and starvation whenever the pressure of population bore down all too heavily upon the limited resources of their fertile intermontane valleys and irrigable piedmont slopes. These great grasslands have thus played their part in the Völkerwanderung, that restless movement of Asiatic peoples seeking easier and more certain sustenance upon the humid peripheral plains and in the well-watered uplands of western Europe.

The steppes are monotonously level, monotonously gray and brown, monotonously bare of forest. Hot and dust-worn in summer, cold and snow-blown in winter, they offer few amenities of weather and season, except when the vernal burst of bloom colors them for a few weeks before the summer heat parches them. Their lack of adequate rainfall, their lack of potable water add to the burden they impose upon the peoples who make their homes upon them.

This lack of water reflects the low annual rainfall, the low rainfall which has left their soils—the chernozems, the chestnut earths, the solonetzes, the solonchaks—so high in mineral content and plant food that many of the soils are among the most fertile of the world, capable of producing the richest harvest of plant growth and cultivated crops whenever the rainfall is sufficient. The fertility of the black soils of Russia is world-known.

Level expanse of fertile soils and crop season of inadequate rainfall are the two major features of the steppes fundamental in the structure of the human society built upon them. These features explain the persistence with which their peoples occupy them, the famines which these peoples must endure, the squalor and destitution and disease which have made life so hard and sordid among the millions of steppe peasantry. They are hard to change, hard to overcome—either by czarism or communism.

ECONOMIC GEOGRAPHY

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THE MESILLA VALLEY OF NEW MEXICO: A STUDY IN ARIDITY AND IRRIGATION

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Geographer, Southern Methodist University

POSSIBLY no well-developed section of the United States possesses the amount of isolation as that possessed by the several irrigated oases of the arid southwest. The Mesilla Valley is an excellent illustration of this fact because within the limits of the irrigation ditch everything is highly developed, but this civilization is isolated from like areas by "seas" of sand, and barren, uninhabited wastes of rocky deserts and half buried mountains. This irrigated oasis is in every respect an "island of the desert."

LOCATION

The Mesilla Valley lies along the Rio Grande in the south-central part of the state of New Mexico and the extreme western part of Texas. About three-fourths of it is in Doña Ana County, New Mexico, and the remaining one-fourth in El Paso County, Texas. The southern end of the valley extends to within a mile of the international boundary between the United States and Mexico (Fig. 1).

The boundaries of the valley are very well defined, being marked by pronounced escarpments or narrow canyons, hence its area is quite definite. The valley proper, which includes that stretch of flattish bottom land either under cultivation or capable of being placed under cultivation with present irrigation practices, has an area of 193 square miles, or approximately 123,500 acres. It is about fifty-five miles long, beginning at the lower end of the Selden Canyon a mile or two above Ft. Selden, and closing with the pass where the Rio Grande again enters a narrow gorge a few miles above the city of El Paso. The valley varies in width from one-half mile to five miles, the average being about three and one-half miles. The sides of the valley are almost as well marked as the two ends, since at the edge of this bottom land on both sides of the river the land rises abruptly, making a sharp contrast not only in the physical landscape, but in the cultural landscape as well.

The general direction of the valley is northwest-southeast, the northern end being about twenty-five miles west of, and fifty miles north of, the southern end.

PHYSIOGRAPHY

The physiography and structural features of the Mesilla Valley are so closely related to a larger unit, the Jornada del Muerto basin or plain, that it is necessary to discuss this larger unit first in order to explain the surface features of the valley proper.

The Jornada del Muerto basin extends from about the central part of the state of New Mexico southward into the Republic of Mexico.

FIGURE 1.—Southern New Mexico and West Texas, showing the location of various units of the Rio Grande Federal Irrigation Project.

It is bordered on the east by a discontinuous range of mountains known as the San Andreas Range, the Organ Mountains, and the Franklin Mountains. On the west it is bordered by the Fra Cristobal Range, the Caballos Mountains, and a few low hills to the south, which taken together make up the southern part of the continental divide for the rivers of the United States.

This plain or "bolson" is typical of many of the intermontane basins of the southwest. It is a flat-bottomed area with edges turned up on all sides like a pan. The floor of the bolson is covered with loose, porous material which has been brought down from the near-by mountains by surface wash. The structure of the bolson has been interpreted as either synclinal, or that of a large graben.

The northern rim of the basin is not as pronounced as the eastern or western rim, but it is marked by a broadly curved ridge of low hills that rise about five hundred feet above the plain. The south side is marked by a complex mountainous belt of country where the bolson extends in finger-like projections between the ridges across the international boundary into Mexico. Roughly, the basin is from thirty to forty miles wide, and more than one hundred and fifty miles long. In several localities the otherwise even surface of the Jornada is broken by low volcanic hills, either extinct craters as in the Doña Ana Hills, or by intrusive stocks, dikes, or lava-capped mesas.

The Rio Grande flows diagonally across the southern end of the Jornada from northwest to southeast, and in doing so has cut a valley in the loose material of the bolson which is from one hundred to four hundred feet below the bolson plain.

The course of the Rio Grande was formerly along the west side of the mountains which make up the west border of the Jornada, and possibly flowed southward into the interior basins of northern Mexico, where its waters were lost in the thirsty sands of that area. Later, volcanic activity near the southern end of the Jornada is supposed to have diverted the river eastward into its present course, causing it to cut a canyon in the Selden area at the north end of the Mesilla Valley, and also at the pass at the southern end of Mt.

Franklin. The hard rock in the canyon at the southern end of Mt. Franklin established a temporary base level of erosion, and since the stream could not deepen its channel appreciably it was forced to meander.

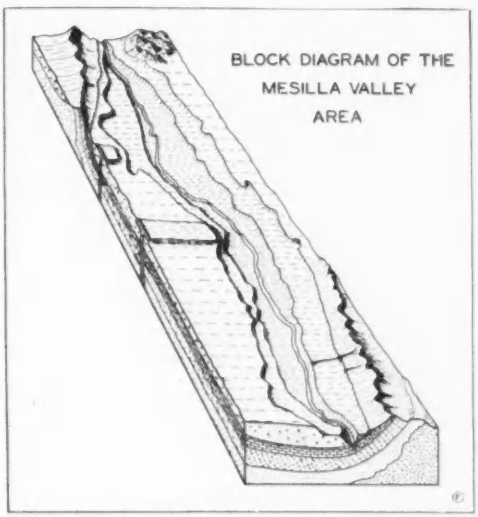

FIGURE 2.—Block diagram of the Mesilla Valley Area.

By lateral planation it has eroded out a flat-floored valley in the porous materials of the bolson which is today known as the Mesilla Valley (Fig. 2).

The walls on each side of the Mesilla Valley are steep, as the plain breaks into the valley with a slope of about one hundred feet to the mile. Near the edge of the valley the material eroded from the upland plain has been distributed along the slopes, the soils of the plain above passing gradually down into the alluvial soils of the valley below. These slopes vary from one-quarter of a mile to two miles in width.

Several small volcanic cones of recent origin occur on both sides of the valley. Lava flows from recent volcanoes on the bolson plain have caused the formation of Black Mesa, a conspicuous landmark which extends along the west side of the valley for several miles north of the village of San Miguel. The slope of the valley wall at that place is covered with fragments of hard black basaltic rock.

The gradient of the Rio Grande through the valley is very slight. The valley slopes from 3,920 feet at Fort Selden to 3,685 feet at its southern end, a difference of only 235 feet for its entire length, or an average fall of about five feet to the mile. The Rio Grande is the only stream in the Mesilla Valley, and within the valley it has no tributaries with a perennial flow. On both sides of the valley small arroyos finger back into the table-land, and serve as drainage ways for the torrential rains that occasionally fall on the surrounding mountains, and on the adjacent mesa slopes. The floor of the valley is almost level. The drainage toward the river is good except for a few local low-lying areas, where alkali deposits are found.

SOILS

The soils of the Mesilla Valley fall roughly into three classes: (1) the gravelly soils of the upland or bolson, (2) the soils of the narrow marginal slopes, and (3) the alluvial soils of the valley floor which have been brought down by the river.

Most of the soil of the upland has been eroded since its original deposition and has been redistributed by surface flood waters, waters of intermittent streams, or by the wind. Alluvial fans occur frequently along the marginal slopes where these intermittent streams enter the valley. In some places the material is markedly stratified, while in other places it is made up of a heteroge-

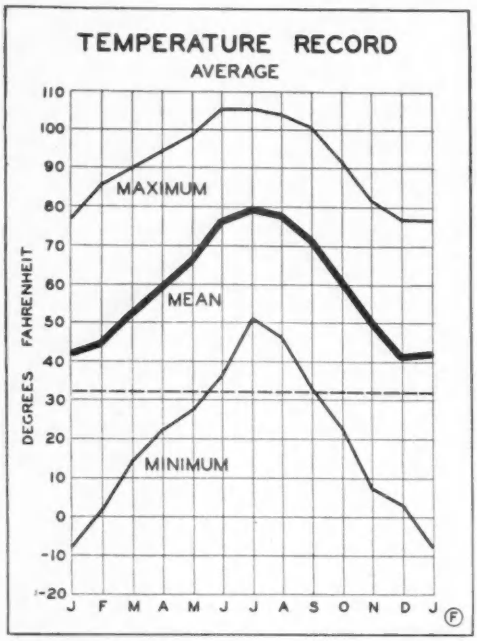

FIGURE 3.—The maximum, mean, and minimum temperature curves are shown on the above diagram.

neous mass of sand, gravel, silt, and clay.

These soils, classified as the Anthony series by the United States Bureau of Soils, are usually quite uniform in appearance, but small variations due to wind-blown sands occur in places.

The soils of the valley floor consist chiefly of alluvial materials transported by the waters of the Rio Grande on its flood plain. Due to the great amount of sediment which is brought down by the river and deposited over the low-lying areas, and also to the heavy deposits of clay and silt from irrigation waters, the soils of this valley have a local complexity such as is found in few localities in the United States, and yet this same complexity exists throughout the entire valley. The mixture is so great that it is not uncommon to find six or more soil types within a single square mile. In many of the fields examined during the progress of the soil survey of the valley in 1912 by the Bureau of Soils, from two to six inches of clay was frequently found, it having been deposited by irrigation waters at the rate of one-quarter to one inch annually.

CLIMATE

The Mesilla Valley lies in that section of the United States that has always been considered "The Great American Desert." While the valley floor is by no means arid, this is an artificial condition brought about by irrigation, and the area as a whole may truly be called a desert.

The chief characteristics of the climate are (1) a wide seasonal range of temperature, varying from more than 100 degrees Fahrenheit during the summer months, to zero and below during the winter; (2) an insufficient amount of precipitation for the growing of crops without irrigation; and (3) a low relative humidity with a high percentage of sunshine throughout the year.

Due to local conditions within the valley, this harsh desert climate is to some extent modified, especially in regard to the temperature.

TEMPERATURE CONDITIONS

One characteristic feature of the climate of the Mesilla Valley is the fact that on the whole the temperature range is mild. Extremes in heat and cold are uncommon (Fig. 3). The days are warm in summer, but are never extremely cold in winter, the low temperatures being confined largely to the nights. On account of the low relative humidity, and the extreme dryness of the atmosphere, the sensible temperature is from ten to twenty degrees lower than the actual temperature. Sunstroke is

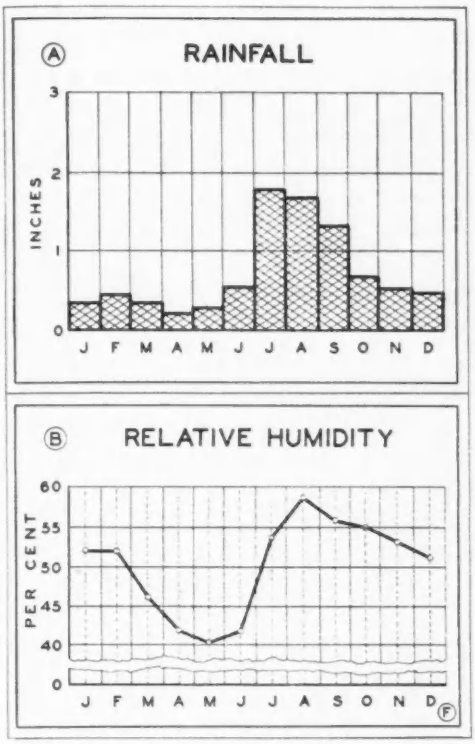

FIGURE 4.—From the above diagram, one can compare the humidity curve with the precipitation curve.

practically unknown in this region, although the thermometer frequently goes above one hundred degrees during the months of June, July, and August.

HUMIDITY AND PRECIPITATION

The relative humidity of the Mesilla Valley is low, the mean annual being about fifty-one per cent. This varies considerably from season to season, and corresponds roughly with the seasonal distribution of rainfall. The relative humidity is lowest in May, before the summer rains begin, being only forty per cent at that time, and reaches its maximum of fifty-nine per cent in August.

The rainfall of the Mesilla Valley is very scant, averaging between eight and nine inches annually. Some rain falls throughout the year, but a greater part falls during the summer months (Fig. 4). The rainfall usually comes in the form of convectional showers, and is of little value to crops.

SUNSHINE AND EVAPORATION

The average number of clear days throughout the year is 225, with another 103 days only partly cloudy. Forty-seven days of the year are classed as cloudy, which is only a little over thirteen per cent of the total. The sunshine chart (Fig. 5) shows the parts of the year classed as either clear, cloudy, or partly cloudy.

From this chart it can be seen that there is a predominance of sunny days throughout the year, with a particularly large number during the fall when a lack of rain and sunny skies is of great value during the harvest season. This is of particular value in the growing and harvesting of cotton, the chief crop of the valley.

This great amount of sunshine has one bad effect upon the activities of man in the valley in that it increases the rate of evaporation, and in so doing, causes a great amount of water to be lost off the land and out of the irrigation ditches.

No accurate record for the rate of evaporation has been kept in the Mesilla Valley, but from certain measurements taken by the New Mexico Agricultural College on a three-foot cubical tank, the evaporation rate varied from sixty-two inches to seventy inches per year.

NATIVE VEGETATION

The chief type of native vegetation found in this region is the southern desert shrub, more commonly known as sage brush. It grows in scattered clumps, leaving much of the ground bare. In addition to this

desert plant, there are several varieties of the cactus plant found, the more important being the Yucca (Fig. 6). Neither of these plants is of any economic value, except as an occasional supplementary feed for range cattle in extremely dry years.

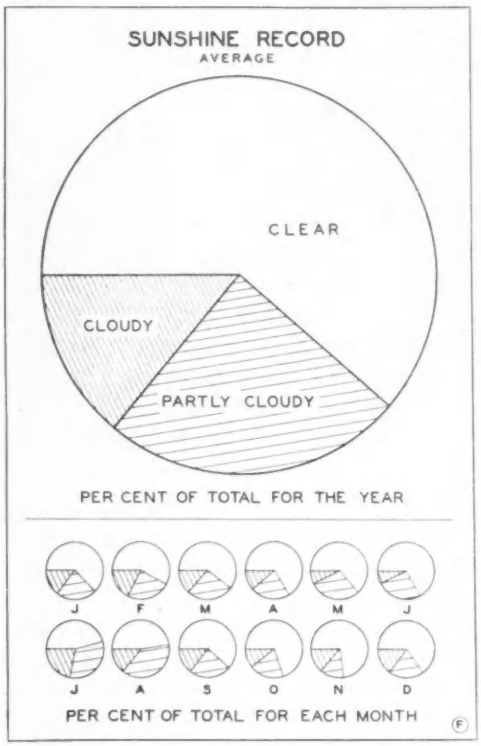

FIGURE 5.—Percentage of sunshine in the Mesilla Valley.

While this picture of native vegetation is not typical of the improved parts of the valley floor, where the entire order of things has been changed by irrigation and other works of man, it is a picture of the surrounding table land or Jornada.

HISTORY OF SETTLEMENT

The Mesilla Valley is one of the oldest settled areas on the North American continent. When civilization and settlement began in this valley is unknown. The people living there at the time of the early Spanish explorations were the Pueblo Indians. Recent investigations have brought to light a still earlier occupancy by a more primitive people.

The four known eras of civilization in the Mesilla Valley are (1) the Pueblo period; (2) the Spanish period; (3) the American pioneer period; and (4) the present period of government control of the irrigation system.

The Pueblo period began in prehistoric times and extended to the time of the Spanish explorations and conquests in the southwest. How long these Indians had lived in the Mesilla Valley is unknown, but from the appearance of their dwellings and irrigation works, they were old settlers there when the Spaniards first arrived. These Pueblo Indians had been cultivating the land of the valley floor for years, bringing water upon the land by "acequias" or irrigation ditches, many of which are still in use. It is estimated that during the height of the Pueblo civilization in the Mesilla Valley alone there were from 15,000 to 20,000 people living on the products raised by irrigation and that the probable area of the irrigated land at that time exceeded 30,000 acres.

The Spanish period began with the exploration and conquest of this region by Cabeza de Vaca early in the sixteenth century, and continued through the period of Mexican control to 1849, when this territory was acquired by the United States. De Vaca was undoubtedly the first European to see the Mesilla Valley, and it was only natural that he should claim it as well as all of the southwest country for the Spanish crown. The coming of the Spaniard added little to the civilization, and for the three centuries of Spanish occupancy

FIGURE 6.—Vegetation on the Jornado. Organ Mountains in background. (Photo by Howard Brown, El Paso.)

and ownership, the Mesilla Valley ceased to progress. Many of the Pueblo Indians were driven out and their lands and irrigation works were not kept up as they should have been. One of the chief crops raised by the Indians was corn. This could be grown easily and the Spaniards continued to cultivate it. When this valley became the property of the United States in 1849, it was in about the same state of development as it was when discovered by de Vaca three centuries before.

The American pioneer period began with the close of the Mexican War, and extended to the time of government control of the irrigation works. The first permanent American settlement was made a few years prior to the beginning of this period. As early as 1825 Mexico made an attempt to colonize the valley by issuing large grants to citizens of that country. A few colonists moved in, but later abandoned their holdings because of the hostility of the Apache Indians. A second attempt was made by Mexico in 1841 when inducements were offered to citizens of Juarez, a Mexican town across the river from El Paso, and also to Americans in the region to settle in the valley. Several large tracts of land were given away at this time, and two pioneer towns, Doña Ana and Mesilla, came into existence as a result of these grants. This was a final effort on the part of Mexico to hold this territory.

For a long time Doña Ana and Mesilla were the most important towns in the valley. After the coming of the Americans, army posts were established in each place, and the latter town also became the county seat of government and the commercial center of the whole area during the time of the stage coach. Later when the railroad built through the valley, the town of Mesilla, thinking that a railroad might ruin its profitable trade, which was at that

time a complete monopoly due to isolation, asked the railroad not to build within eighty miles of the town. The railroad, however, built its line a few miles to the east through the village of Las Cruces, which has since become the commercial center of the valley. Since that time Mesilla has largely been deserted, and its old adobe houses are crumbling rapidly.

The railroad was completed through the valley in 1881, and gave direct connections between El Paso and Albuquerque, where it connected with the main line of the Santa Fé system. This road traversed the entire length of the valley, and no one thing has had as much influence upon its development as this first and only railroad. It is interesting to note that no other railroad was ever built through this valley.

With the completion of this line in 1881, a number of settlers came into the region, but most of them settled in the small towns, or went on to El Paso, and a large part of the valley was left to be cultivated by the Mexicans and Indians. As time went on, and more settlers came in, there was an increased demand for water for irrigation purposes, and the agitation for government control and improvement of the irrigation works began.

The present period began about 1908 with the completion of the Leasburg diversion dam at the northern end of the Mesilla Valley (Fig. 7). Later, this became a part of the Elephant Butte project under the control of the United States Reclamation Service. The series of events that led to the organization of this irrigation project, and the construction of the Elephant Butte Dam cannot be discussed here, but a few of the main points will be mentioned. In the first place it seemed to be a difficult matter to interest the reclamation service in this area because all of the land to be benefited by the project was under private ownership, and much of the land was already irrigated. In connection with all of the other irrigation projects in the western part of the United States there has been an abundance of unoccupied government land that could be sold to the settlers, and in this way pay for the cost of the project, but there was no such inducement here. As in the case of other irrigation projects, the

FIGURE 7.—Leasburg Diversion Dam across the Rio Grande at the head of the Mesilla Valley.

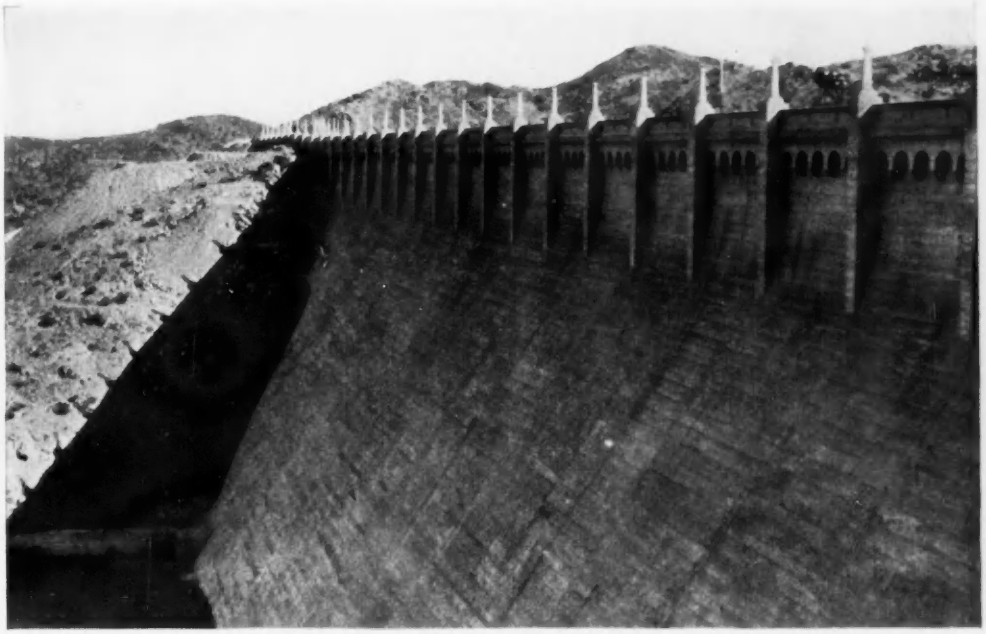

FIGURE 8.—Elephant Butte Dam for storing the waters of the Rio Grande.

money used by the reclamation service had to be appropriated by a congress composed of representatives from forty-eight states, and it did not seem reasonable that the other states would see the necessity of spending a large sum of money, then estimated at $7,200,000 for the benefit of only a small part of Texas and New Mexico. If this had been the only means of obtaining government aid, it is highly doubtful whether the great Elephant Butte Dam would ever have been constructed. About this time the government of Mexico filed claims against the United States which amounted to several million dollars as compensation for the damages suffered through lack of water by the farmers on the south side of the Rio Grande below El Paso. This claim made it imperative that the United States government do something to check the flood waters of the Rio Grande, and to provide a storage reservoir so as to regulate the flow of the river throughout the year. Plans were started at once, and construction on the great Elephant Butte Dam was soon begun (Fig. 8).

Since the completion of this dam and other smaller ones, and many irrigation and drainage ditches, at a cost of approximately $13,000,000, development has gone on rapidly in the valley.

With the control of the flow of the Rio Grande, and the elimination of floods, agriculture has been placed on a stable and profitable basis, and the Mesilla Valley has developed more since 1908 than it had in all of the years of its history prior to that time.

CHARACTER AND DISTRIBUTION OF POPULATION

Detailed figures on population are not available for a unit smaller than Doña Ana County, but practically all of the people of this area live in the irrigated valleys. Since only a small

FIGURE 9.—Mexican settlement at edge of valley. (Photo by Howard Brown, El Paso.)

part of the Mesilla Valley lies in Texas, the population figure for Doña Ana County (16,548 persons in 1920 according to the 1920 U. S. Census Report) can be taken as the approximate combined population of the Mesilla and Rincon Valleys in Doña Ana County, New Mexico.

The Rincon Valley is small and sparsely settled, and an estimate of 1,500 people for that part of the valley that is in Doña Ana County is very liberal. The reasons for the Rincon Valley being so sparsely settled as compared with the Mesilla Valley are (1) a very limited amount of irrigable land; (2) lack of railroad facilities in most of the valley; and (3) the distance from the El Paso market. By subtracting the 1,500 people of the Rincon Valley from the total population of Doña Ana County, we have approximately 15,000 people living in the Mesilla Valley. This is only an estimate of population, but it is the best available, and the writer feels that from his observations in the field, this is a fairly close estimate.

The character of the population of the Mesilla Valley is in striking contrast to border communities. In most of the border counties of New Mexico and Arizona where mining is the chief industry, the population is composed largely of Mexicans, but in the Mesilla Valley where agriculture leads, 76.4 per cent of the people are native white. The fertile soils and abundance of water call for a progressive farming class, and a smaller proportion of unskilled Mexican laborers than at the mining camps. Of the remainder of the population, about 99.5 per cent are Mexican. This preponderance of Mexicans over other foreigners in the Mesilla Valley is due to (1) the nearness of this valley to the Republic of Mexico; and (2) the heavy population pressure in the liveable portions of Mexico, that forces its poverty-stricken people to seek a living outside of their own country. These Mexicans have been of great value to the farmers by supplying them with a willing and inexpensive type of farm labor. Mexicans are to the Mesilla Valley what Japanese are to the California Valley around Sacramento, except that the Mexican seldom buys land of his own and is content to be a laborer on the farm of the American.

While many of these Mexicans come into the Mesilla Valley from

FIGURE 10.—Typical farm residence of the Mesilla Valley. (Photo by Howard Brown, El Paso.)

the southern republic to help in the harvests, and go back across the border after the season is over, a large number of them make their permanent homes in the region. The homes of these Mexican workers are in striking contrast to those of the land owners. Due to the high price of irrigated lands, practically all Mexicans live on the dry lands either in the outskirts of the city of El Paso, or near the pass on the mesa at the foot of the mountains. These latter settlements usually take the form of a small village with a dusty street lined on both sides with one-story adobe houses (Fig. 9). Vegetation is usually lacking in these settlements, and poverty is everywhere dominant. This type of settlement, a definite part of the Mesilla Valley community, presents a striking contrast to the well-built homes and orderly farms of the irrigated lands. The differences between the types of people who settled in these areas must be considered, however, in explaining this contrast.

CULTURAL AND ENVIRONMENTAL LANDSCAPE

Both from a cultural and an environmental point of view this area may be described as a region of contrasts. The Mesilla Valley proper with its productive land gives one a very favorable impression of the development of the region. Here are thriving towns and flourishing farms (Fig. 10). Most of the bottom land is under cultivation and capable of producing high crop yields per acre. Within this valley most of the people of Doña Ana County live, although this valley comprises only a small part of the total area of the county. The Jornado, or table land, on each side of the valley, offers a very marked contrast to this picture. It has a fertile soil, but lacks the chief element of the environment that would make it productive, namely water. Since this Jornado is from 100 to 300 feet higher than the river, it could only be irrigated by lifting the water to this level by a series of pumps, a system entirely too expensive for its present land value. As a result this area is barren. No agriculture is carried on here and very few people can be found. The only animals raised here are the beef cow and the goat.

In the valley proper, where irrigation under gravity flow from the Rio Grande is possible, everything is

thriving and prosperous. Farms, farmhouses, roads, railroads, and towns show their prosperity everywhere. On the Jornado, the opposite is the condition. There are no farms, no farmhouses except an occasional dilapidated ranch house built of adobe, no railroads, very poor roads that hardly deserve the name of trails, and no permanent settlements.

ECONOMIC ACTIVITIES

Agriculture is by far the most important industry in the Mesilla Valley. By the term "agriculture," we mean to include the production of all irrigated crops in the valley bottoms. This includes such crops as cotton, alfalfa, corn, fruits, and vegetables. In addition to these crops, dairy farming and poultry raising might be classed as agriculture since they belong to these same irrigated farms. Another activity that, although growing in importance, will always be subordinate and subsidiary to agriculture in the Mesilla Valley is that of transportation. The people engaged in this activity range from the employees of the Santa Fé Railroad to the individual truck drivers engaged in hauling milk and other produce from the valley farms to the creameries and markets of El Paso.

Two other sets of activities that are carried on entirely outside of the valley and yet influence the development of the valley to some extent are (1) the grazing activities, carried on the mesa or Jornado area, and near-by mountain ranges, that find their markets only through the Mesilla Valley; and (2) the mining, smelting, and manufacturing activities that influence the people of the Mesilla Valley by providing a near-by market for crops.

IMPORTANCE OF IRRIGATION IN CROP PRODUCTION

Due to the low rainfall, and high rate of evaporation in the Mesilla Valley (Figs. 4 and 5), agriculture without irrigation is impossible. The modern economic life of the region is dependent upon the irrigation ditch as is shown by the mediocre development of the region due to haphazard irrigation practices prior to the construction of the Federal Irrigation Project.

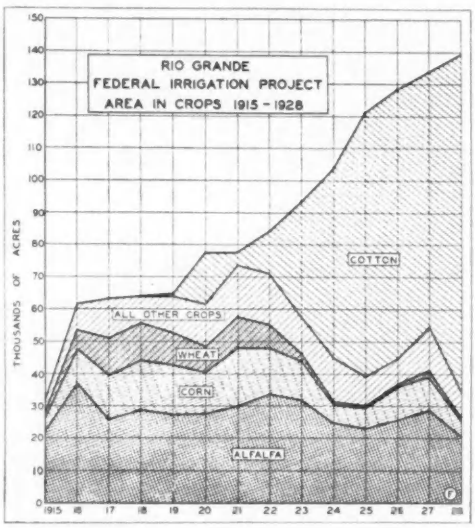

FIGURE 11.—Increase in the crop acreage on the Rio Grande Federal Irrigation Project since 1915. Note the remarkable development of cotton and the accompanying decrease in value of other crops since 1912. (Data supplied by U. S. Reclamation Service at El Paso.)

As irrigation is the basis of all life in the valley, it has likewise brought forth a higher type of civilization than could have been developed in the non-irrigated portions of the arid southwest. Some of the advantages of these irrigated lands are (1) soils of arid regions are usually more fertile due to a low rainfall and therefore less leaching of their humus content; (2) bottom lands in irrigated areas

are continually fertilized through the additions of silt after each irrigation; (3) crops are rarely hindered in their growth by cloudy weather (Fig. 5); (4) crops can be given the proper amount of water at the time when most needed; (5) the harvest season for all crops is a dry season. This last factor is especially favorable to the production and harvesting of the two major crops, cotton and alfalfa.

LAND UTILIZATION

Since 1919, agriculture has made a great change on the Elephant Butte or Rio Grande Federal Irrigation Project, as is shown by Figure 11. Before 1919 alfalfa was the dominant crop, occupying more than one-half of the land under cultivation. Since 1919 the valley has witnessed a most remarkable development in cotton cultivation.

A well-recognized principle of land utilization for crops is that the more fertile land tends to be used for the more productive crop, and the increase of cotton acreage at the expense of the other crops in this area is an excellent verification of this principle.

In analyzing this chart (Fig. 11), it should be noted that the total acreage for the project has more than doubled between 1919 and 1928. Cotton has not only taken up this new land, but it has also crowded out the staple crops of the valley, particularly wheat, corn, and alfalfa, so that in 1928 cotton occupied nearly three-fourths of the cultivated land area (74.5%), alfalfa about one-sixth (14.7%), and the remaining crops about one-twelfth. Wheat was the first major crop to be driven out (it now occupies less than one per cent of the cultivated area) due to the fact that it was the least productive crop and could not be grown profitably on high-priced lands. Corn, while holding up better than wheat (3.6% in 1928) is gradually being crowded off of the irrigated lands. A small amount of corn will be grown, however, on the valley lands in spite of the high price, as feed for stock.

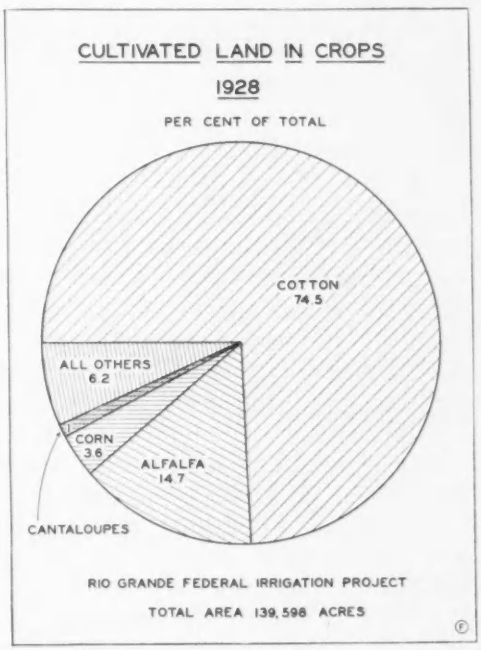

FIGURE 12.—Cultivated land in crops on the project in 1928.

Of all the other crops in the region, alfalfa alone seems to be holding its own as to total acreage under cultivation. There was in 1928 approximately the same number of acres under cultivation as in 1915, although the 1928 acreage was about one-third less than the peak which was reached in 1916, and again in 1922. In the percentage column, however, alfalfa dropped from sixty-seven per cent in 1915 to about fifteen per cent in 1928, but during that same period, the area of the cultivated land in the project increased from 32,000 acres to 139,000 acres. The fact that alfalfa has

been able to remain on a certain number of acres of this valuable land in competition with cotton has been due to its use as a feed for dairy cattle and other farm stock. Many farms that have most of the acreage in cotton still maintain a small plot in alfalfa to feed local stock and dairy cattle.

Cotton

Cotton, although one of the newest of the irrigated crops in the Mesilla Valley, is today the most important crop (Fig. 12). The first cotton to be planted in this valley in modern times was at the New Mexico Agricultural Experiment Station in 1891. However, it was many years later before cotton growing on a commercial scale was developed in the Mesilla Valley.

For a number of years cotton had been grown successfully in the Pecos Valley of eastern New Mexico, but it was generally considered that the climate of the Mesilla Valley was unfavorable for cotton culture. A careful study of weather conditions in both the Pecos and the Mesilla Valleys revealed the fact that as far as climate was concerned, cotton could be grown as successfully in the Mesilla Valley as around Roswell in the Pecos Valley. The question of the cold nights as a result of the high elevation had often been looked upon as a limiting factor in the production of this crop, but experiments proved that this theory was wrong.

The first cotton to be grown in the Mesilla Valley on a commercial scale dates from 1916, but it was not until 1919 that cotton as a commercial crop showed any prominence. Since 1919 the increase in cotton acreage in the Mesilla and other near-by valleys under the Elephant Butte project has been almost phenomenal (Fig. 11).

FIGURE 13.—Picking cotton by hand in the Mesilla Valley. (Photo by Howard Brown, El Paso.)

Due to a short but definite winter season in the Mesilla Valley, only one crop of cotton can be grown in a year. However, as a rule there are from three to four pickings from one planting (Fig. 13). The first picking usually begins about fifteen or twenty days after the first bolls open. The average date for the first picking is about September 21, for the second about October 8, for the third about November 6, and for the final, if there is a fourth picking, about December 7. As a rule killing frosts occur before the first of December, and by that time all of the cotton that is going to mature is open.

Cotton seems to thrive on almost any type of soil in the Mesilla Valley, the yields per acre being little affected by soil conditions, provided other things are favorable.

Since cotton is entirely a cash crop, the farmer must seek his market wherever the price is the best. Most of the cotton is ginned in the valley (Fig. 14) and sent to the local El Paso market, but this is so far from the centers of large demands for cotton, and from large textile mills,

FIGURE 14.—Typical cotton gin and yard in the Mesilla Valley. (Photo by Howard Brown, El Paso.)

that the El Paso market has been a rather unsatisfactory one. With the establishment of the El Paso Cotton Mills Company (Fig. 15), which is erecting a textile mill worth some $500,000, there seems to be some hope of utilizing much of the crop in making coarse cotton cloth from the cotton produced in the area. On account of its exceptionally long staple, and the whiteness of its fiber, this valley cotton is becoming well known throughout the country and is being sought more and more each year by cotton buyers.

The net cost of producing an acre of cotton on the project, after giving credit for seed at $28.00 per ton, was $53.67 in 1926 and 1927, of which $37.45 was for labor. Cotton requires more labor per acre than any of the field crops of the valley, but ranks under that of the truck crops. The peak of the demand for labor comes at the time of picking during the months of September, October, November, and December. As few, if any of the farms have sufficient labor to take care of the cotton harvest, laborers have to be brought

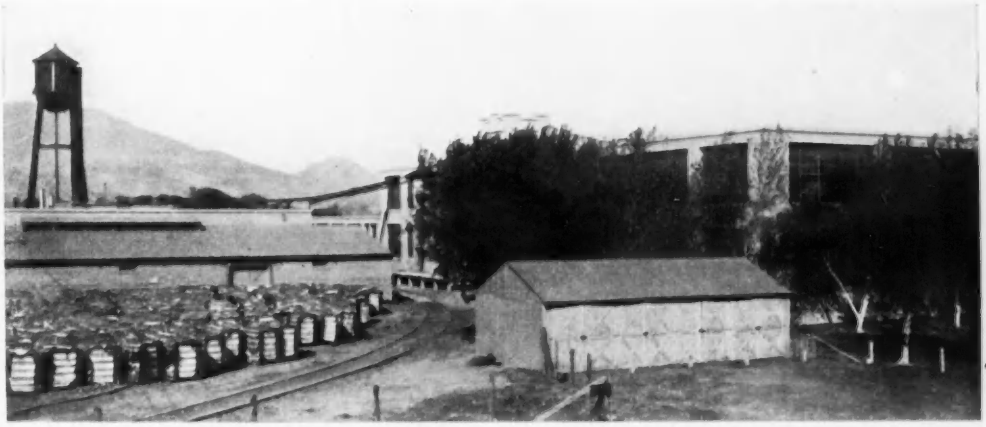

FIGURE 15.—The El Paso Cotton Textile Mill. This plant consumes much of the cotton produced in the valley. (Photo by Howard Brown, El Paso.)

FIGURE 16.—Even Mexican children are used as cotton pickers during the harvest season. (Photo by Howard Brown, El Paso.)

in from the outside, particularly from Mexico, and the labor of women and children is utilized for the picking (Fig. 16). These Mexican workers are hired by the day. The wage rate is very low, being usually $1.50 for a nine-hour day. The farmer usually houses the laborer during the time that he is working for him, with the understanding that the laborer will work for him when he has work to be done, but the farmer does not guarantee any definite amount of work.

While this type of labor is not particularly efficient, it is quite profitable to use it with the present wage scale, and it is doubtful if a mechanical cotton picker will ever compete very successfully with hand labor in this region as long as the low wage scale remains. The heavy fruiting (Fig. 17) of the cotton and the long harvest season are also unfavorable to the use of mechanical pickers.

So important has cotton become in the last few years, and so rapid has been the increase in the number of acres planted, that some uneasiness is being felt by the more conservative farmers of the region for fear that it will become a one-crop area.

Alfalfa

Throughout the state of New Mexico, alfalfa has been grown for many years, and its acreage for the entire state has increased each year. As has been noted, the alfalfa acreage for the Mesilla Valley region has remained about constant, although this crop now occupies only about one-sixth of the cultivated land in contrast to one-half of the acreage in 1919, and nearly three-fourths in 1915 (Fig. 11).

Since alfalfa is grown entirely by irrigation in the semi-arid Southwest, its production is confined to the valley floor, and no acreage is found on the Jornado or in any other part of Doña Ana County.

Alfalfa is planted on as smooth and as nearly level land as possible so that when irrigation waters are applied they will cover the land evenly, and penetrate all parts of the field to an even depth. Both fall and spring plantings are successful under irrigation.

The amount of water necessary for each irrigation and the number of irrigations required each season for a crop will vary greatly with the fertility and texture of the soil. Even if both types of soils are fertile, a coarse one should have lighter and more frequent irrigations than a heavier one. The most profitable yields of alfalfa, on the fertile, well-drained lands of the valley, come from the use of about nine inches of water per ton of alfalfa hay. This is

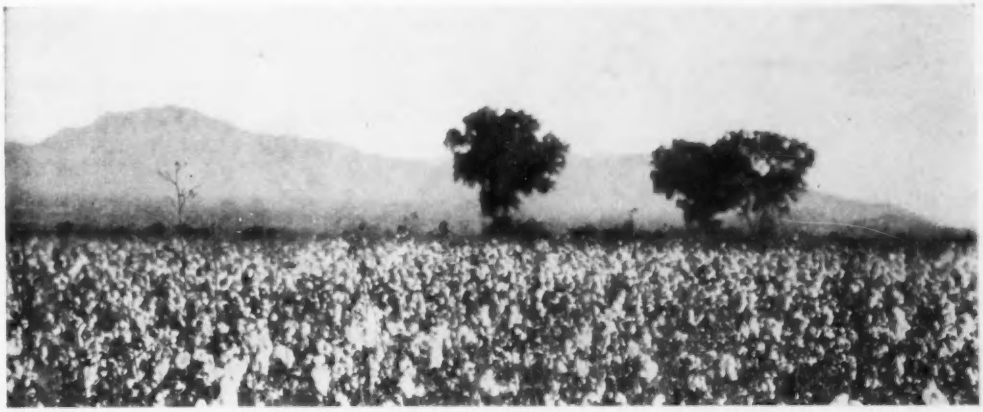

FIGURE 17.—Typical stand of cotton in November. (Photo by Howard Brown, El Paso.)

usually applied in two irrigations, one just after the previous crop is removed, and the other just a few days before the crop is out. Throughout the Mesilla Valley there are on an average four crops of alfalfa raised annually.

Alfalfa is usually harvested as soon as about one-fourth of the plants bloom. On account of the great amount of sunshine in the Mesilla Valley, alfalfa can usually be bunched within six or eight hours after it is cut (Fig. 18). It is more economical to bale the alfalfa in the field, but in spite of this many farms in the valley haul the hay and bale it at the barn door.

Alfalfa prefers a deep, calcareous, well-drained fertile soil. Other things being favorable, the duration of a stand of alfalfa depends upon the soil type, the treatment given the crop, and the depth of the underlying sand strata in the subsoil.

As a rotation crop, alfalfa can fit only into a long schedule. Under irrigation it is used almost universally for this purpose, and the Mesilla Valley presents no exception to this rule.

Good average yields for alfalfa in the Mesilla Valley vary from three to five tons per acre. This yield is rather low and is a result of an attempt to grow the crop on some soils to which it is not adapted, or to inefficient methods of cultivation. If a little more attention were paid to these details, the average yield per acre could perhaps be doubled throughout the valley.

The total cost of producing an acre of alfalfa when baled was $51.89 in 1926–1927. With an average yield of 4.6 tons per acre, this made a cost of $11.28 per ton.

Most of the alfalfa grown on the project today is used to feed work stock and dairy cattle. Because of this, and because alfalfa will serve as a rotation crop, it will likely continue to be of importance in the valley even though immediate returns may not be as large as those from cotton. The principal market for any surplus hay produced in the valley has been for some time in southeast Texas and Louisiana, due to favorable freight rates to those sections.

Table I gives the freight rates per ton to important markets from Las Cruces, the chief town of the Mesilla Valley, and from its competitors. It will be seen that Las Cruces has an advantage in freight rates on the

FIGURE 18.—Alfalfa ready for baling. (Photo by Howard Brown, El Paso.)

New Orleans market with the exception of Kansas City, and that it ranks second to Roswell on the Houston, Galveston, and San Antonio markets, while it is surpassed by both Roswell and Kansas City on the Dallas and Ft. Worth markets. From this it may be seen that freight rates are quite favorable to the marketing of surplus crops of alfalfa.

TABLE I*

Shipping Point	*Houston*	*Galveston*	*Fort Worth*	*Dallas*	*San Antonio*	*New Orleans*
Las Cruces, New Mexico	8.70	8.70	8.70	8.70	8.70	10.70
Phoenix, Arizona	11.20	11.20	11.20	11.20	11.20	12.80
Roswell, New Mexico	8.20	8.20	8.20	8.20	8.20	11.20
Kansas City, Missouri	9.60	9.60	8.40	8.40	9.60	8.50
Antonito, Colorado	13.70	13.70	10.80	12.50	13.70	16.10
Rocky Ford, Colorado	12.20	12.20	9.20	11.00	12.20	12.80

* Extension Circular No. 97, p. 15.

Corn

Due to its wide range of adaptability, corn is today the most important single crop in the state of New Mexico, but it is only a very minor crop in the Mesilla Valley. This statement seems contradictory, but may be explained by noting the environmental requirements of corn, and the value of a corn crop in comparison with other crops that are raised in the Mesilla Valley. Corn can be grown on almost any type of land found in the state, and as it has a low water requirement, due to its ability to use more of the soil moisture, it is not especially suited to the irrigated bottom lands of the Mesilla Valley. Furthermore, corn is a crop that is grown by extensive agricultural methods, and the small farms and high-priced land of the valley bottom are not suited to a crop that requires a large acreage and low-priced land for profitable cultivation. Although corn was for years the leading crop of the Mesilla Valley, it is being rapidly replaced in modern times by the more intensive and profitable crops such as cotton and alfalfa.

Corn culture in the Mesilla Valley dates back into antiquity. It was one of the first crops planted here by the Franciscan Friars who settled in the valley in the sixteenth and seventeenth centuries. This, however, was not the beginning of corn culture in the valley, since these Spanish monks found the Pueblo Indians in this area growing a type of grain, known to them as maize, by very crude methods of irrigation.

With modern irrigation practice in the Mesilla Valley, and with it the marked advance in the price of land, corn culture in this valley, as well as in other irrigated valleys of the state, has been on the decline. It has been pushed out into the dry farming sections of the country and its place taken by the more profitable cash

crops such as cotton, alfalfa, vegetables, and fruit so that only a small portion of the total acreage (3.6 in 1928) of the valley is planted at present in corn (Fig. 11), and this acreage is decreasing rather than increasing.

Since corn is relatively a cheap crop, and irrigated lands are high in value, the factor of prime importance in corn culture here is a matter of high yield per acre. At the experiment station near Las Cruces, a number of varieties of corn have been tested, and yet, from several hundred varieties, only four have produced yields that warrant their permanent continuance in the valley. Throughout this area the Standard Mexican June corn predominates, and its yield is sufficient to justify its growth (Fig. 19).

Ordinarily about four six-inch irrigations are necessary to mature the crop. The first irrigation is applied either just before or just after plowing and planting. The second irrigation is not given until the crop shows a need for water. The third and fourth are applied in a similar manner. At no time from the early flowering period until the growth ceases should the crop be allowed to suffer from a lack of water.

The harvesting of corn begins in August, when that part of the crop that is cut green is placed in the silo. The harvesting continues throughout the fall and far into the winter. Because of a scarcity of labor at this time, due to the demands made by cotton, much of the corn is bound with a row binder, shocked, and later threshed in the field. With the introduction of the silo into the valley there is a growing tendency toward the use of late maturing frosted corn for silage. In many instances this is preventing a complete loss of the crop.

The production cost per acre for corn in 1926–1927 was $42.52. With an average yield of 52 bushels per acre the cost was 81 cents per bushel.

FIGURE 19.—Mexican June corn develops great stalks while producing grain. It is interesting to compare this with the height of the man in the picture.

The cost of harvesting corn for silage was $18.67 per acre, making a total cost of $57.17 per acre, or $3.52 per ton with a 16-ton yield.

All of the corn produced was used locally, and this was only twenty-two per cent of the total grain consumed on the project. It will be seen that grain is a product of importation and not for shipment. The average local price for corn (about the only grain grown in the Mesilla Valley) was $1.00 per bushel during the years 1921–1927, but even at this price, it cannot compete with cotton, and the corn acreage is likely to continue to decrease in the future.

Wheat

Although wheat at one time was a fairly important crop of the irrigated district, it has declined in importance so that today it occupies less than one per cent of the area in crops. From 1917 to 1922 wheat held its own in acreage, but was gradually pinched out of the irrigated lands (Fig. 11). The small cash return from wheat in comparison with cotton, alfalfa, or truck crops prohibits its occupation of the fertile valley lands. The small wheat acreage will soon disappear.

Vegetables

As marketing facilities increase, and as the population becomes denser throughout the Mesilla Valley, truck farming is becoming important. Although the total amount of land in truck seems small in comparison to the cotton and alfalfa acreage, trucking is an intensive type of farming, as a very few acres may yield large amounts of produce.

The two most important truck crops raised in the Mesilla Valley are cantaloupes and tomatoes. These are usually raised as a cash crop on almost every farm in the valley because of the ease and small expense of cultivation, and the good financial returns. The light sandy soils are the best for these crops. As a rule, from eight to nine irrigations are necessary for melon culture, although this will depend largely upon the season, and the moisture-retaining power of the soil. The quantity of water applied should be greatest at the time of maturity.

Some of the chief advantages of the Mesilla Valley for truck farming are (1) crops will mature ten to eighteen days earlier than in any other part of New Mexico; (2) field labor is possible every day throughout the growing and harvesting season; (3) soils are rich and well suited for truck; (4) labor is cheap and abundant; (5) El Paso furnishes a good local market for truck crops; and (6) good railroad transportation is available to the chief northern markets.

In recent years cantaloupes have become quite important, and in 1928 they occupied one per cent of the total area of the project (Fig. 12). Pre-harvest costs of producing cantaloupes are not much more than for the field crops, being on an average about $50.00 per acre. However, harvest costs amount to as much per acre as all the pre-harvest costs, making the total about $100.00 per acre. With an average yield of 234 crates per acre the production cost of cantaloupes was 42.8 cents per crate.

With an average market price of 46 cents per crate during the last seven years, it requires about 200 crates per acre for the farmer to make expenses. During the last four years the market price averaged only 38 cents per crate, which would require about 300 crates per acre to make expenses. Unless prices improve considerably in the near future, or unless much better yields per acre are secured, cantaloupes cannot hope to compete with cotton for land, and will be driven off of the project in the near future.

Tomatoes and cabbages are also produced in commercial quantities in the valley. However, they are subordinate to cantaloupes.

Fruits

Fruit trees were formerly of great importance in the Mesilla Valley, but due to the frost hazards on ac-

count of the altitude of the valley floor, and to the competition of cotton, many of the best orchards (Fig. 20) have been taken out in the last few years and the land planted in cotton.

The most important fruits produced in the valley today are the apple, pear, and peach. However, the industry is declining in importance, and will likely give way entirely to cotton, as it cannot justify its claim to the land. In the near future the only fruit trees to be seen in the valley will be in the yards of the farmhouses, and the fruit will be for table use only.

FIGURE 20.—Fruit orchards of this type are rapidly disappearing from the Mesilla Valley.

LIVESTOCK

The raising of livestock in the Mesilla Valley and surrounding territory is both an old and a new industry. On the open ranges cattle, sheep, and goats have been raised for years, perhaps centuries, but, due to the poor means of transportation and lack of facilities for handling meat and meat products, this industry remained at a standstill for a long time. In the early days of the development of the Mesilla Valley comparatively few animals were raised on the irrigated lands, as the land itself was thought to be too expensive for such occupation, and the beef cow, the sheep, and the goat were crowded back out of the valley bottom to the surrounding table lands and hills. These animals are now found entirely on the non-irrigated lands of the Jornada, and not in the Mesilla Valley proper. The only place where they influence the activities of the valley is in the transportation to market. The only railroad running north out of El Paso, west of the Franklin Mountains, is a branch of the Santa Fé that connects with the main line and routes to the east of Albuquerque. This is the chief line for shipments of beef cattle to the Chicago, Omaha, and Kansas City markets. This railroad runs through the Mesilla Valley and the cattle must be loaded into cars in the valley towns, to be shipped to these markets.

In recent years there has been a tendency towards the raising of dairy cattle and other domestic animals on the irrigated lands of the valley floor, and, as the population has increased, both dairying and poultry raising have become important.

Beef Cattle

Large herds of beef cattle are raised on the Jornado back from the irrigated lands of the valley. They live chiefly on the scant bunch grass of the mesa, but their feed is sometimes supplemented by the yucca. The chief breed of beef cattle found is the Hereford, and the herds are as a rule in good condition (Fig. 21) in spite of the poverty of their pasture land.

FIGURE 21.—Beef cattle on the mesa lands adjacent to the valley. (Photo by Howard Brown, El Paso.)

Goat raising is also important on some of the dryer parts of the area.

Dairying

The distribution of dairy cattle through the valley follows no definite order, and it might be said that dairying and dairy farming exist anywhere in the valley where the individual farmer has a desire to cultivate fodder crops on his farm, to care for milk cows, and to market their products. However, dairy farms do follow some definite locational order in that they tend to be more numerous near El Paso and Las Cruces, and more scattered away from these centers. They are also more numerous along the two main highways that traverse the valley, and less numerous back from these highways.

As yet, the average size of the herds here is rather small, possibly not over three or four cows to the herd if the whole farming area in the valley is considered, or not more than fifteen cows to the herd if just the larger dairy farms are considered (Fig. 22). These small herds are possibly explainable by the comparatively recent development of good roads in the valley, and by the youth of the industry. Holsteins form the most important herds of the valley. Fifteen years ago dairy farming was practically unknown in the valley, and the dairy products used were imported largely from the other states. The little milk that was supplied locally came from the small town dairies. The chief reason for this lack of development was the lack of adequate transportation.

FIGURE 22.—Holstein cattle on a dairy farm of the valley floor.

There was no suitable way of getting the milk and milk products to the markets, and about the only means then possible was the utilization of the Santa Fé Railroad. At that time it was a very dangerous trip to attempt to drive to El Paso in an automobile, and the idea of an auto stage line that would daily carry the milk from the dairy farms to the city markets was unthought of. In the last fifteen years the Mesilla Valley has advanced from a backward section in regard to dairying to a highly developed region that now supports a dairy cattle population of over 3,000 highly bred cows. One of the chief factors that has led to this advance in the dairy industry is the development of coöperative marketing associations for the sale of dairy products throughout the valley.

Some of the factors that have caused the Mesilla Valley to become a good dairy region are (1) an extra long pasture season and practically no winter, which reduces shelter charges considerably; (2) the two essential crops to the most economical dairying, corn and alfalfa, are grown to a perfection; (3) in marketing problems, the farmer of this region does not have to face opposition from powerful, long-established, and efficient milk dealers; and (4) the dairy farmer is protected from outside competition by the perishable nature of the product, and the long distance to other competing sections, with great tracts of arid land unsuitable for dairying intervening.

Although dairying is still in its infancy in the valley, it should be one of the important industries of the future, and as the population of the region increases, additional dairy farms will likely come into existence. Even at the present time there is more demand for dairy products in the city of El Paso than can be supplied from the Mesilla and other irrigated valleys around the city. As the creameries and butter factories increase, there will be more need for dairy cows to supply this demand. Already, one brand of butter known as "Desert Gold" is being marketed at distances from the area.

Poultry Raising

Poultry raising is another industry that is in its infancy. It is an industry which has never received the just share of attention in this locality that its possibilities for profit warrant. The demand for eggs in the city of El

Paso is much greater than the supply in the irrigated valleys around the city and many cars of eggs are shipped there each month. Although poultry raising will never be one of the leading industries of the valley, it will certainly rise to meet the need of this local demand.

Climatically, the Mesilla Valley is ideal for poultry raising. Because of the mild winter climate, and the absence of prolonged wet weather, expensive housing is unnecessary. Green feeds are available at all times of the year, and poultry of all kinds and all ages can range out of doors the year around. Recently, turkeys have been raised in the valley. These turkeys are a great help to farmers in ridding their crops of grasshoppers and other such pests, and at the same time they require little feed until just a short while before they are marketed.

Possibly, the one most important thing that has developed the poultry industry to where it is now is the coöperative selling agencies for poultry products. A great advantage of the coöperative method of selling is that the product to be sold can be graded and classified, and when placed on the market, it has the guarantee of the association behind it as to its quality.

TRANSPORTATION FACILITIES

El Paso holds one of the most strategic locations from the point of trade of any place in the Southwest. El Paso is called the "Gateway City" because it is a focal point of north and south traffic between the United States and Mexico, and of east and west traffic between the eastern states and the Pacific coast. The Mesilla Valley, being near El Paso, shares in this strategic location.

As the name implies, El Paso is located at the mouth of a pass, where the Rio Grande breaks through the mountains from the Mesilla Valley to the El Paso Valley, and this pass has been very important in the development and growth of the city. The

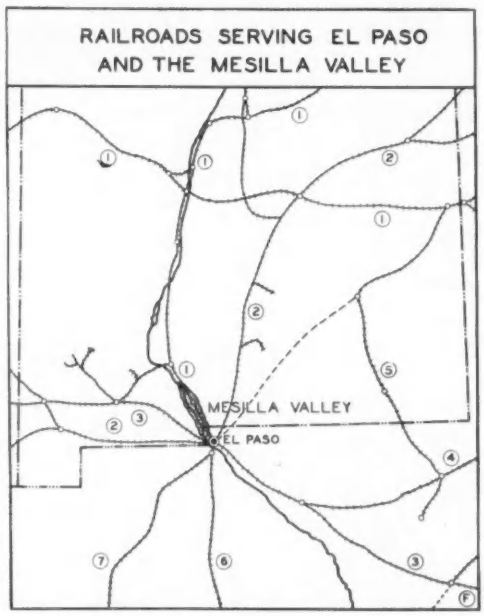

FIGURE 23.—Railway lines serving El Paso and the Mesilla Valley.

pass was first used as a highway by the Spanish Conquistadores in carrying gold between Santa Fé and Mexico City. The old road came north from Mexico City, east of the mountains until it reached the Rio Grande. It then followed this river in a northwest direction through this gap in the mountains, and thence on the west side of the mountains to Santa Fé. In going northward from El Paso the road followed the river through the Mesilla Valley, and climbed out of the valley at its northern end and crossed the Jornado. About the only traffic through the valley before the coming of the railroad was in this north and south

direction, and this had dwindled away until it was of little importance.

About 1875 the period of railroad building began in the Southwest, and in a few years El Paso was the terminus or division point of a number of lines. The first railroad reached the city from the north in 1881, following this old north and south route through the Mesilla Valley and the pass. This was the only line built in a north and south direction, and hence the only one through the Mesilla Valley. By this time the heaviest traffic was in an east and west direction, and the other railroads entered El Paso from the east or northeast, and then built westward through the pass toward the Pacific coast.

The railroad lines in the southwestern part of the United States and in the northern part of Mexico are shown on the map (Fig. 23). Route 1 (on map) is the main line of the Atchison, Topeka, and Santa Fé Railroad, from Chicago to California, which crossed the mountains about 300 miles north of El Paso, near Albuquerque. It is a branch of this road that extends southward through the Mesilla Valley into El Paso. Route 2 is a branch line of the Southern Pacific system, which was formerly owned by the Rock Island system. It connects with the Rock Island at Tucumcari, New Mexico, and provides a direct route from Chicago to California, by way of El Paso. Route 3 is the main line of the Southern Pacific Railroad which extends from New Orleans to San Francisco. This road also crosses the mountains through the pass just northwest of El Paso. Route 4 is the Texas and Pacific Railroad, that built westward as far as Sierra Blanca, and connected with the Southern Pacific there. Route 5 is another branch of the Santa Fé Railroad from Kansas City, that turns south at Roswell, New Mexico, and follows the Pecos River Valley into Pecos, Texas, where it connects with the Texas and Pacific for El Paso. A line has been projected by this company (see dotted line on map) to cross the Sacramento Mountains just west of Roswell, and continue into El Paso. This is a much-needed route, as it will give El Paso and the surrounding irrigated valleys another direct railroad line to the markets of the North and East.

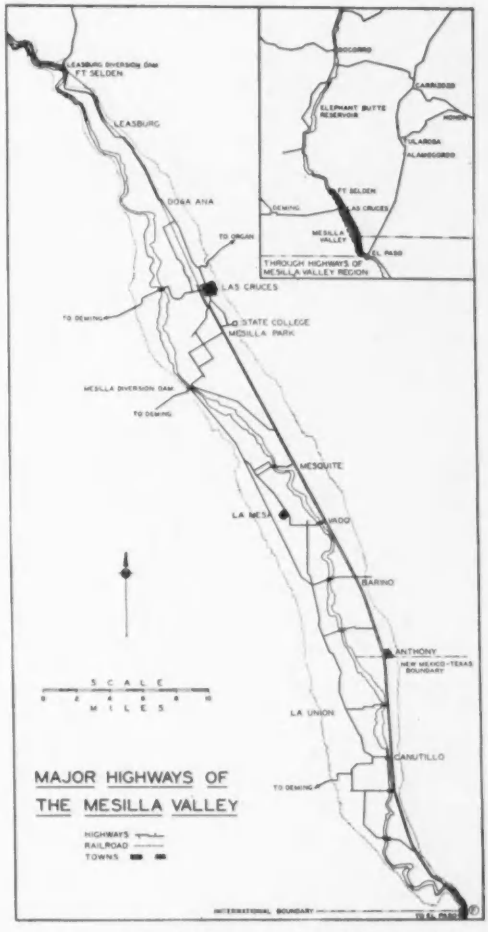

FIGURE 24.—Highways of the Mesilla Valley area.

Routes 6 and 7 are the Mexican National and the Mexican Northwestern Railroads, that give the El Paso region a connection to the south with Mexico City. This is a revival of the old north and south trade route.

Only one of these seven routes selected the Mesilla Valley to enter El Paso, and from this it might appear that the valley had very poor transportation facilities. However, because of the proximity of the Mesilla Valley to El Paso, this one line furnishes ample facilities for handling produce from the valley farms. In fact, the narrowness of this valley would make a second railroad line, paralleling the first, superfluous.

In addition to the railroads there is a well-developed system of highways in the Mesilla Valley (Fig. 24). The main highway on the east side of the river is paved with concrete for its entire length of over forty miles. This road runs from Las Cruces into El Paso, and is an important artery of travel in carrying produce into the latter city. On the west side of the river, paralleling this paved road, is a graveled highway in excellent condition, which connects the farms on the west side of the river with El Paso. Numerous cross roads connect these two highways, and the river is bridged every few miles. Possibly no farming section in the United States has a better system of public roads than has this valley. A well-developed motor transportation system serves the valley farms by means of these highways.

It will be noted that all of the traffic lines of the Mesilla Valley focus upon El Paso, but since this city is the focal point of all railroads in this region and offers adequate rail transportation in all directions, and since the Mesilla Valley has only one railroad leading out directly toward the north, it is not surprising that practically all of the produce of the valley reaches its market either in El Paso, or by way of El Paso.

MARKETS FOR MESILLA VALLEY PRODUCTS

Markets have already been discussed in connection with each of the more important crops raised in the Mesilla Valley. The two things that are of most interest to note here are (1) the locations of these markets, and (2) the rail and highway connections between them and the valley farms.

There are three types of markets for produce from this valley: (1) the near-by urban market of El Paso; (2) the mining camps of southern New Mexico and Arizona, which use a large part of the truck crop; and (3) the distant markets such as Kansas City, St. Louis, Chicago, New Orleans, and the larger Texas cities.

The El Paso market is connected with the Mesilla Valley by both railroads and highways. The markets of the second group are connected directly by fair highways, and indirectly by railroads. The distant markets of group three have good rail connections with El Paso, and practically all of the produce of the Mesilla Valley bound for these markets is carried through this city.

SUMMARY

The Mesilla Valley, a section of the larger Federal Irrigation Project, commonly called the Elephant Butte Project, lies in an arid region where agriculture without irrigation is impossible. After the construction of various irrigation works by the United States Reclamation Service,

FIGURE 25.—Great dunes of wind-blown sands are found near the edges of the Mesilla Valley. (Photo by Howard Brown, El Paso.)

agriculture developed in this valley to the exclusion of all other industries. This agricultural development has been phenomenal in its growth since 1915. The crops of the valley floor show a close adjustment to the high value of the land. Alfalfa, formerly the dominant crop, now holds a poor second to cotton, a more intensive crop for irrigated lands of the Southwest. Cotton is likely to continue in its domination of the best land as long as the price remains high. Outside of the valley proper, on the dry mesa lands where irrigation is impossible under present conditions, stock raising is the only industry.

The markets for the Mesilla Valley are either local, for the more bulky and perishable products, or else at a great distance for commodities that can stand a long haul, as the region is surrounded on all sides by large areas of desert wastes (Fig. 25) which tend to isolate the valley from similar areas, and make it in every sense of the word an "Island of the Desert."

LAND UTILIZATION IN THE SCABLANDS OF EASTERN WASHINGTON

Otis W. Freeman
Geographer, State Normal School, Cheney, Washington

DECIDED contrasts in land utilization occur on the Columbia Plateau in eastern Washington between the "Palouse hills" and the channeled Scablands that interlace in a mystifying manner across the plateau. The area discussed lies within the Big Bend of the Columbia River east to Idaho, south of the Spokane River and north of the Snake River.

The bedrock consists of thick basaltic lava flows with a few "island" hills of crystalline rock, called "steptoes" by Russell in his "Geology and Water Resources of Nez Perce County," after Steptoe Butte, rising above the lava. Lake beds, called the Ellensburg formation, were deposited on the surface of the lava plateau in the western part of the Columbia Basin. Both the basalt and the lake beds are pervious, and surface streams are, therefore, relatively scarce. A mature topography was developed by the Pleistocene period on the plateau in Washington. Little residual soil was formed from the bedrock. The surface soil was largely of loessial origin and had been heaped into hills, elongated southwest to northeast, by the wind, according to J. Harlen Bretz. During the glacial period a tremendous flood that resulted from the very rapid melting of an ice sheet, poured down across the plateau, which slopes towards the confluence of the Snake and Columbia rivers. This flood devastated the country. It was in places hundreds of feet deep. Divides were overtopped, and vast anastomosing streams washed away the surface soil in their beds and, by plucking out the basalt, excavated numerous deep basins, many of which now form lakes. The bare basalt is locally called "scabrock." The intermingled channels formed by flood erosion are called "scablands." Large bars were deposited by the flood, and the Quincy Basin, in southern Grant County, was largely buried under sand and gravel. The area of the scablands is about 2,800 square miles, with 900 square miles additional buried in débris left by the flood. Figure 1 illustrates the anastomosed character of the scablands.

The scablands include numerous smaller channels within the main canyons, pits, buttes, elongated lake basins, mesas, steep cliffs, dry waterfalls, "hanging valleys," "islands" of the original loess covered mature relief, isolated columns, and other erosional forms. The erosional and depositional forms are wholly the work of running water. The giant streams are extinct, but the evidence of the flood remains. Before the flood the area was covered with deep, fertile loess; after the flood the lower land affected by the catastrophe was barren scabrock, pitted by numerous basins containing ponds and lakes, and covered by débris in many places forming bars and other deposits.

Since the epochal formation of the

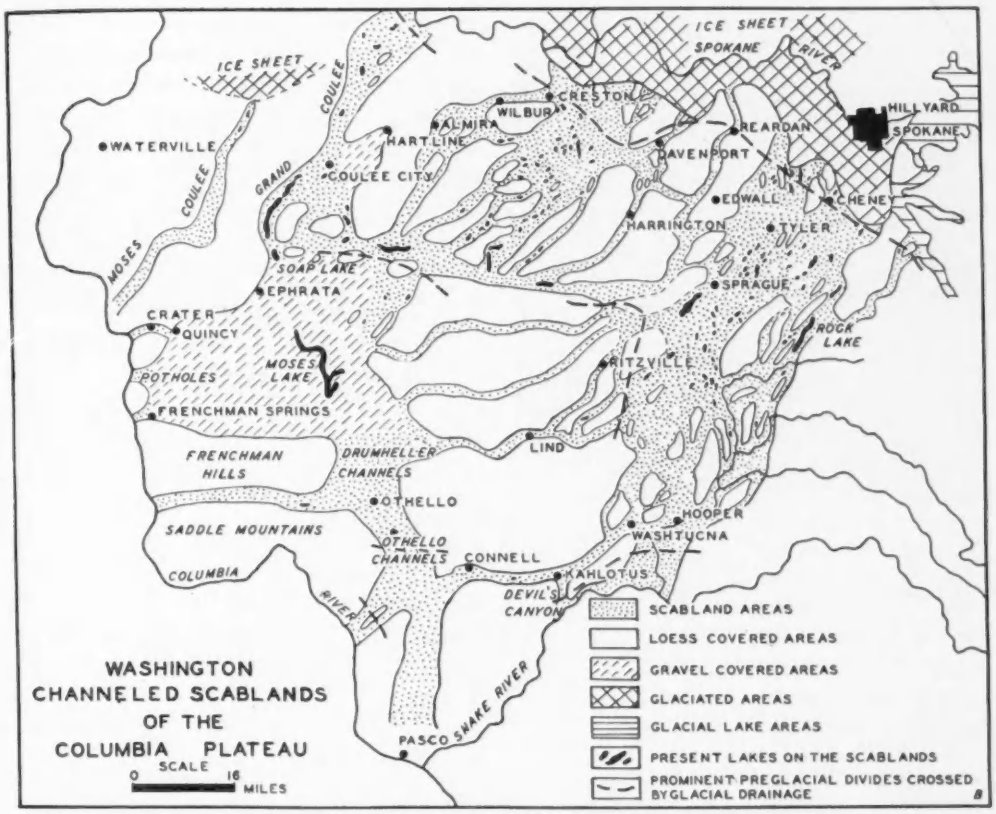

FIGURE 1.—The Channeled Scablands of the Columbia Plateau in Washington. (After Bretz, *Journ. of Geol.*, Vol. 31, 1923.)

scablands, numerous ponds have been filled with vegetation and the muck or peat soils thus formed are valuable additions for farmers' use. Thousands of small, scattered mounds, formed chiefly from volcanic ash cover sloping outcrops of scabrock. The mounds result from erosion of ash beds, and generally they occur above depressions in the scabrock where quick growing vegetation would hold the material. The soil of the mounds is fertile, and the depression helps contain moisture for crops, although their small size makes cultivation of mounds a difficult problem.

CLIMATE

The climate of eastern Washington has important effects upon land utilization. The annual rainfall of the scablands varies from 6 to 25 inches (Fig. 4). Precipitation comes mainly in the winter. Summer drought prevents crops like clover from being raised, and if unusually prolonged may injure grain and hay. Summers are hot and winters are moderately cold. The growing season varies from less than 100 to over 200 days, depending on altitude and exposure. Regions free of late spring and early fall frosts are used for fruit and vegetables, especially where water is available for irrigation. Above the ten-inch isohyetal, wheat is the major crop on the uplands, and hay in the scablands. Without irrigation, regions below ten inches annual rainfall are used principally for grazing of sheep and cat-

FIGURE 2.—Rough timbered scabland at the Hole in the Ground.

tle. The rainfall is reliable and normally varies only slightly from the average. However, some regions, like the Big Bend, have suffered from lessened rainfall in most years since 1915, and considerable farm land has been abandoned in the driest localities as a result of drought.

Where the rainfall exceeds 15 inches annually, the native vegetation on the scablands consists mostly of yellow pine (*pinus ponderosa*), with quaking aspen and willow around the swamps and water holes. The drier scablands were covered with bunchgrass and sagebrush. The moist uplands of Palouse soil supported no timber, being prairies covered with tall grass forming a heavy sod. The dry uplands had sagebrush and bunch grass.

SOILS

The soils of eastern Washington have been developed under conditions that vary from humid to arid. In the east, next the Coeur d'Alene and Blue mountains, are podsolic, brown forest soils. Forests extend into the scablands to the 15-inch isohyetal and affect the soils of the northern scablands, especially on water-laid deposits of gravel whose good drainage promotes leaching.

FIGURE 3.—Dry waterfall at head of Rock Lake. Note the sterile character of the surface of the basalt that is locally named scabrock.

The best soils of the scablands are peat and muck meadows of drained swamps, and loess of the numerous small mounds. The Palouse, a fertile black to chocolate brown prairie

soil, Chernozem of the Russian pedologists, covers residual hills of mature topography in the moist eastern section of Spokane and Whitman counties. It is developed under a rainfall of about 15 to 22 inches annually, and possesses a well-developed carbonate zone at a depth of around three feet. The Palouse is the most important soil type in Basin. Irrigation is needed for successful farming in the desert, the rainfall of 6 to 8 inches providing only scanty grazing.

GEOGRAPHIC SUBDIVISIONS OF THE COLUMBIA PLATEAU IN WASHINGTON

The Columbia Plateau in Washington may be divided into human use

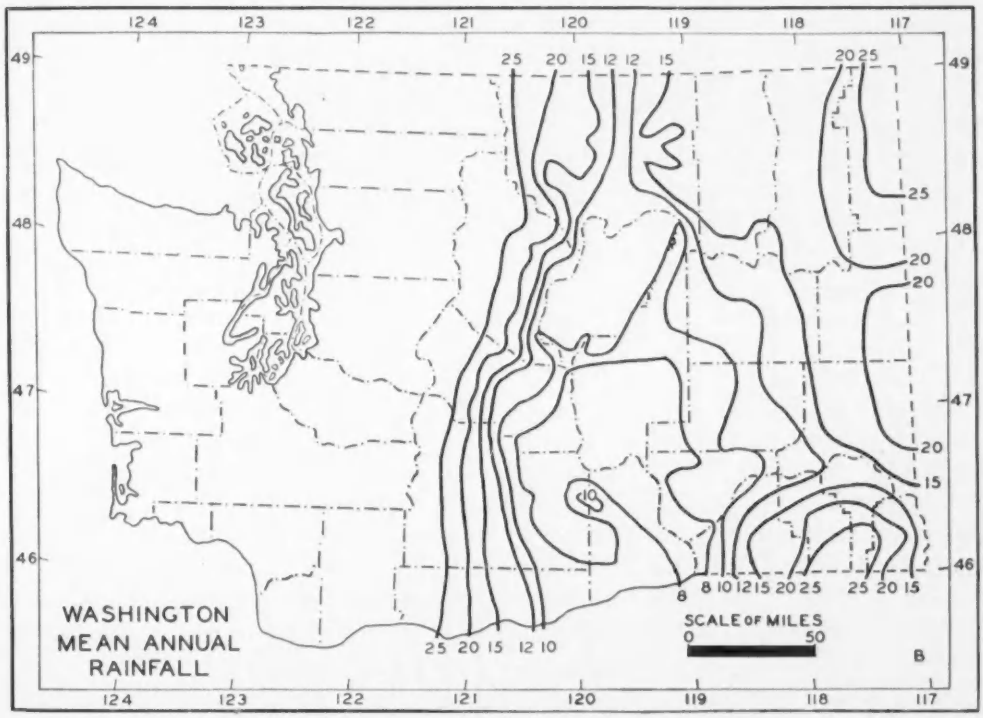

FIGURE 4.—Mean annual rainfall map of State of Washington.

Washington and produces the majority of the wheat grown. The Ritzville has a similar origin to the Palouse, but is developed under 8 to 12 or 15 inches annual rainfall, which gives the soil a red to light brown color, with a carbonate zone at 24 to 30 inches. The Ritzville is an excellent soil, and fine crops of wheat are raised on it when the rainfall is sufficient. The light brown phase of the Ritzville gives way to gray desert soils in the Columbia

regions which coincide closely with natural climatic, relief, and soil divisions. The divisions suggested are shown in Figure 5, and include the following:

(1) Palouse Region, a local name long used for the rolling hills of "Palouse soil" in Whitman County, devoted to growing wheat, since the rainfall is ample. The country rises from 1,300 feet in the southwest to over 2,600 feet near the Idaho line. The boundaries suggested are the

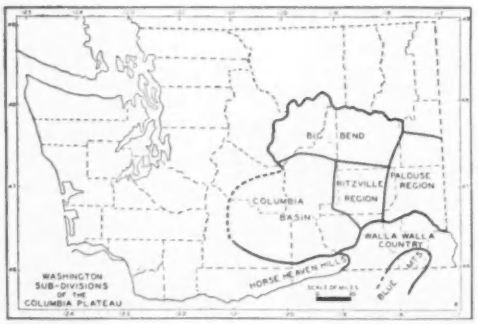

FIGURE 5.—Subdivisions of the Columbia Plateau of Washington.

Mica Peak-Almira Ridge on the north to Deep Creek and thence generally southward in the scablands to the junction of the Snake and Palouse rivers. The Snake River is the southern boundary, and Idaho the eastern boundary, although the region really extends some distance into Idaho.

(2) Walla Walla Region, for the uplands and valleys that lie in a crescent between the Blue Mountains and the Snake River, excepting a triangular strip 15 miles east of Pasco that is included with the Columbia Basin. The Walla Walla Region is noted for successful agriculture because of favorable soil and climate.

(3) The Big Bend, which extends from the Palouse Region on the east at Sprague, westward in the channel of Crab Creek, to Soap Lake. Thence, the south slope of the Badger Mountains would be the boundary to the Columbia, the great bend of which stream serves as the western and northern boundary line. The elevation of the region varies from 1,400 to over 2,600 feet. Part of the western Big Bend lacks adequate rainfall for successful agriculture, but in its eastern half wheat raising is especially favored by nature.

(4) Columbia Basin, which includes associated valleys and anticlinal mountains, extends from the Quincy Basin just south of the Badger Mountains in the north, to the Cascades on the west, including the Yakima Valley, Kittitas Valley, Columbia Valley, Frenchman Hills, Saddle Mountains, Yakima Ridge, and Rattlesnake Mountains, to the Horse Heaven Hills on the south, then eastward to include the basin around Pasco, and thence northward to the Big Bend on about the western line of Adams County. The Columbia Basin is desert land, very productive when irrigated, but nearly useless for dry farming, and only of moderate use for grazing.

(5) The Ritzville and Horse Heaven Hills regions are transition zones from the desert to the more humid Big Bend, Palouse, and Walla Walla regions. The Ritzville Region centers in Adams County, and extends a short distance north, west, and south into adjoining counties. The Horse Heaven Hills are between the Columbia and Yakima rivers. The Ritzville and Horse Heaven Hills are mainly covered with Ritzville soil, which over large areas forms rolling "Palouse hills." The Ritzville Region has successful wheat farming in the east, and border line farming in the west, which is lower and drier than the east. The Horse Heaven Hills are rainier to the west and drier to the east where farming is precarious and much land has been abandoned.

SETTLEMENT OF THE AREA

The Lewis and Clark expedition was the first milestone towards the settlement of eastern Washington. Soon after this expedition made known the resources of the area, fur traders established posts at strategic

FIGURE 6.—Pothole near Othello. Many such potholes contain pools of water which are often the only supply available for livestock. The green feed available in summer in the potholes is also valuable. Stock raising, especially of sheep and cattle, are the only possible industries of this region.

points on the waterways which were the arteries of commerce at that time, a century ago. Fort Walla Walla near the confluence of the Snake and Columbia rivers, Fort Okanogan at the junction of the Columbia and Okanogan rivers, Fort Colville at Kettle Falls just below where Kettle River joins the Columbia, were the outstanding examples of fur-trading posts in the area.

That the country was good for agriculture was early proved by missionaries, who in the 1840's raised crops in the Walla Walla Valley, and former employees of fur companies,

FIGURE 7.—Ranch in Drumheller Channels near Othello. Rainfall below 8 inches annually. Typical scabland used for grazing, the sagebrush and scattered grass clumps providing forage for sheep and cattle. Hay is stacked for winter feed on the irrigated bottom land along Crab Creek, which is almost the only stream flowing through this region, and by providing stock water, determines the location of most of the large ranches.

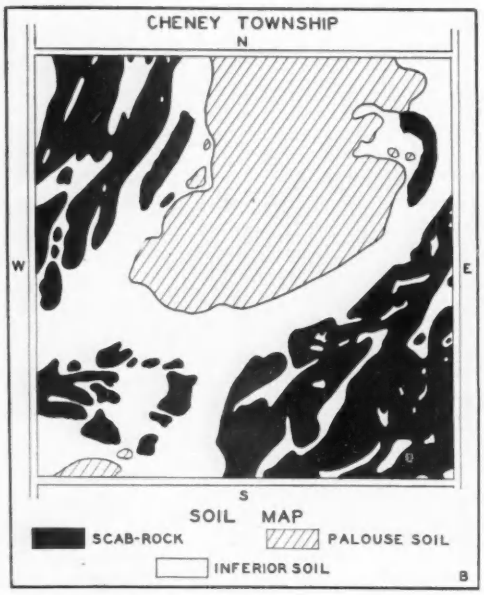

FIGURE 8.—Soil Classification map of Cheney Township, Washington.

who even earlier turned to farming and stock raising in the Colville Valley.

Discoveries of gold in the late fifties and early sixties in Idaho, Oregon, Montana, and British Columbia caused a great influx of miners who explored the whole region, laid out trails, founded supply cities like Lewiston, Idaho, and made known the advantages of the region for agriculture. The mines provided markets for crops and livestock, and encouragement was given to these industries. Former miners and other settlers in the late sixties began to locate ranches on which cattle, horses, and sheep were kept. The locations were made along streams, at lakes, or springs to control stock water. Such water supplies were usually in the scabland channels, and the prairie uplands were available for free range. Wells were rarely dug or drilled during the time of the open range. Hay and other crops were raised on bottom lands.

The discovery, made about 1880, that wheat would grow splendidly on "Palouse hills," together with completion of the Northern Pacific Railroad in 1883 led to rapid settlement. Between 1880 and 1900 the best open range was taken for homesteads and stock raising declined. After 1900, settlers, encouraged by several rainier years, filed on semi-arid and even desert land. Hundreds of homesteads on the border line or within the desert have been abandoned since 1915, principally in the western Big Bend, Columbia Basin, and Horse Heaven Hills regions.

PRESENT LAND UTILIZATION

The present use of land depends primarily on soil and rainfall. Length of growing season and date of the last frost in spring locally affect fruit production. Irrigation may overcome scanty rainfall if supplies of water are available. The isohyetal map, Figure 4, shows general increasing rainfall outwards, west, north, and east from the desert Columbia Basin that receives only 6 to 8 inches. The desert requires irrigation for agriculture, wheat raising by dry farming methods having been tried with poor results. Under 10 inches annual rainfall, wheat raising is precarious, and succeeds only in years of above average rainfall or times of high prices for wheat. Between 10 to 15 inches annual rainfall, wheat farmers usually summer fallow their land every other year. When the rainfall increases to 15 to 18 inches annually, wheat growers summer fallow their land about once in three years. Given 20 inches annual rainfall, most farmers grow a crop of wheat every year. In the scablands hay is raised without irrigation, especially on drained peat swamp land

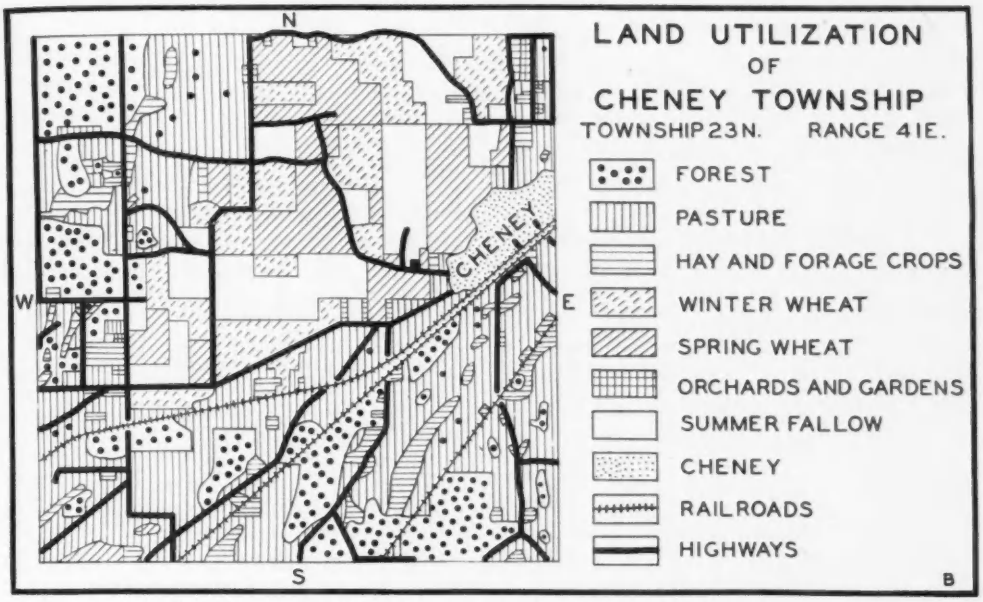

FIGURE 9.—Land Utilization map of Cheney Township, Washington.

where the annual rainfall exceeds 10 to 12 inches. Below this rainfall alfalfa and other hay must usually be artificially irrigated except on some bottom land that is naturally sub-irrigated. In the northern and rainier scablands timothy hay is most common. Grain and native grass is also cut for hay. Alfalfa only grows on land with good drainage, which, therefore, keeps timothy the chief hay crop of wet meadows. Corn, sunflowers, and sweet clover are sometimes grown for forage.

Palouse and Ritzville soils are used almost exclusively for wheat raising. In the scablands the coarse gravel soil of the bars and other water-laid deposits has excessive drainage, the peat meadow land is frosty and wet in the spring preventing seeding wheat in time for it to mature before the hot summer drought, and the scabland mounds are too tiny for economic use of machinery. Besides, nearly all areas of tillable soil in the scablands are so irregular in shape that farming operations are awkward and uneconomic. Therefore, wheat is not raised for grain in the scablands, although it often is planted and cut green for hay.

All the region has abundant sunshine during the crop growing season, and the growing season is everywhere sufficiently long for hay and grain. Fruit is not successfully grown for market with much less than 150 to 200 frostless days. Such situations are generally in protected valleys and the Columbia Basin. Irrigation is almost always necessary for fruit. In the scablands fruit is raised commercially on the valley fill of lower Moses Coulee, in Grand Coulee near Coulee City, in the northern Quincy Basin near Ephrata, and along the Columbia at such places as Hanford, White Bluffs, and Kennewick. The most important fruit sections—the Yakima Valley, Wenatchee Valley, Walla Walla Valley, and Spokane Valley—are outside of the scablands area.

Eastern Washington is well served by railroads supplemented by electric lines and highways. Railway transportation is rarely over ten miles distant from cultivated farms so the haul to rail is usually not expensive.

INDUSTRIES OF THE SCABLANDS

Stock raising is the chief industry wherever the annual rainfall is less than 10 to 12 inches. Cattlemen, among the first permanent settlers of the scablands, found water more frequently there, than in the grassy uplands where, however, they found the low-carrying capacity of the range. In narrow tracts of scabland, adjacent to farming country, stock raising is carried on as a side issue by men who devote more attention to wheat farming. Whether a ranch is wholly or only in part devoted to stock, the buildings are usually in the scablands, since stock water is available more generally there. The best ranches are located along valley flats, which allow the production, by irrigation, of hay for winter, and provide green feed all summer by sub-irrigation, as along

FIGURE 10.—Meadow in the scabland near Cheney which provides summer pasture for dairy cows. Similar small meadows grow most of the hay produced in the scablands. They have been formed by the filling of small shallow lakes by vegetation.

excellent feed. Well-grassed land with adequate rainfall has passed from the free range into private ownership for many years and today is used for grain raising. The only free range now consists of dry, rocky, or sandy wastes, of low-carrying capacity, usually remote from stock water, and, therefore, of little use. Cattle-, sheep-, and horse-raising are the only possible industries for the driest, poorest scablands. Scattered stock ranches, located at available water supplies in the scabland tracts, consist of several thousand acres each, and can support their owners since their large size compensates for

Crab Creek and Cow Creek. Sheep use dry sagebrush flats for winter range, since snow furnishes all the water they need at that time of year. In the summer the flocks are taken to the mountains, and the waterless desert areas are unused.

Dairying is an important industry in the scablands south of Spokane, where meadows, that provide hay and adequate summer grazing for cows, under a rainfall of 15 to 20 inches annually, are adjacent to a large city market. Besides supplying local demands, Spokane creameries ship many carloads of butter east during the year. The most im-

portant dairying section is near Cheney. The dairy farms are distributed in the broad scablands, wherever the numerous, irregular-shaped meadows and patches of soil permit, that are scattered among the forests of yellow pine. The meadow soil is naturally poorly drained, and best supports timothy, native, and grain hay. A comparison between the soil map of Cheney township, Figure 8, and the land utilization map, Figure 9, shows the peculiar character of tillable scabland soil areas on which dairying depends, compared with the large, regular fields of wheat on Palouse soil. Some feed is available on scabrock during the late spring, but during the summer drought the cows must depend for green feed on meadows, and other swampy places. Hay is fed six months of the year, and the number of cows kept depends on the hay raised. Concentrated feed must usually be bought. At present prices, many dairymen are losing money. The hope for the future lies in reducing costs by improved quality of stock, better feeding, better management of pastures and hay meadows, and the avoidance of hired labor, if possible. It is probable that the industry might succeed better if the units were larger, since a survey at Cheney showed less than 15 milch cows per herd kept on farms averaging 465 acres of which 128 acres were tilled.

FIGURE 11.—Badger Lake, ten miles south of Cheney. Used for fishing and pleasure resorts. Many such attractive lakes were formed in the scablands by the plucking action of the flood currents on the fractured basalt.

A former industry on the scablands was raising timothy hay for sale to teamsters working in the lumber woods. This was an important industry from about 1890 to 1915. It has now declined because of the substitution of tractors for horses, and the less productivity of the meadows used for timothy. The hay raised is now mostly fed to dairy cows and other stock on the farms producing it.

Wood sold for fuel, and minor

FIGURE 12.—View near Four Lakes. Scabland is mostly timbered and extends part way up the hillside. The bottom land under cultivation was secured by draining a swamp. The rougher and poorly drained lowland is pasture. The hill has mature, loess-covered relief. Apple orchards are planted on slopes most free of frost. The upper fields grow wheat.

amounts for sawn timber provide a winter occupation and needed income on many farms in the timbered section of the northern scablands. Prices secured for saw logs are moderate, and the cord wood brings $9.00 per cord delivered. Wood choppers, therefore, receive little more than wages for the time spent in cutting and hauling their trees, but the money earned is a useful addition to their income from dairying and comes when it is hard to secure other work.

Gardening is carried on for home use and local sale where the soil makes it possible. The soil preferred for vegetables is neither excessively drained, allowing damage in droughts, or saturated with water to make it cold and sour. Scabland mounds are often used for corn, melons, and garden truck since the soil is deep and holds water well. Frost damage is more common in the scablands than in the higher lands nearby. In the drier scablands, gardens are placed in the bottom of potholes to have the advantage of sub-irrigation. Market gardening is a very minor industry in the scablands, but home gardens help materially to support the farmers.

Grains, such as wheat, rye, barley, and oats are sometimes grown in the scablands, but areas of suitable soil are small and isolated from each other, making cultivation difficult. Besides, it is difficult to plant wheat early enough in the spring to insure maturity before summer drought injures the crop. Oats are more frequently threshed. Most grain is cut green for hay. Some corn and sunflowers are raised for silage.

Minor sources of income to residents of the scablands include highway maintenance of the many main roads crossing and following scabland channels, renting boats, and supplying other demands of bathers, fishermen, and picnickers who visit the numerous scabland lakes, and leasing hunting rights, especially for ducks that frequent lakes and potholes. One man is raising skunks for their fur, his farm being a 25-acre island in Sprague Lake.

DETAILED MAPPING OF CHENEY TOWNSHIP

Striking contrasts in land utilization reveal themselves between areas of Palouse soil and scablands.

FIGURE 13.—Steptoe Butte, an "island" of crystalline rock surrounded by lava flows of the Columbia Plateau. This is the butte after which Russell named steptoes. The rolling hills planted to wheat are of Palouse soil and offer an interesting contrast to the relief and scenery of the scablands.

Cheney township contains within its 36 square miles about half of a large "island" of Palouse soil. The balance is scablands, part of which is covered with inferior soil, and the rest barren scabrock. The soil map, Figure 8, is modified from a soil map of Spokane county by Van Duyne, Mortlock, Heck, and Alvord. The land utilization map, Figure 9, was surveyed by the writer in 1928.

From a comparison of the soil and land utilization maps of Cheney township, it is seen that the Palouse soil is almost exclusively devoted to wheat, and that in 1928 when the survey was made, 99 per cent of the area of that soil was in winter wheat, spring wheat, and summer fallow which became wheat in 1929. The farms in the scablands raised timothy, native hay, and grain hay on small, irregular plots of drained swamp land, and strips of inferior soil, with some gardens and crops planted on scattered scabland mounds. Very little summer fallowing is done in the scablands, owing to small areas of tillable land available, sub-irrigation existent on much of the lowlands, and purpose for which crops are raised, which, being hay rather than grain, will produce more of value if cropped each year.

In Cheney township, farms on the Palouse soil run in size from 160 to 1,710 acres. Because 160 acres are hardly enough to support a family by raising wheat, the operators of such sized farms usually lease additional land. A half section or more returns a satisfactory income for a family. However, management is of vital importance, and some owners of large farms are not making expenses at the present price of wheat. Good farmers tend to control the best soil here as elsewhere. During the last five years wheat farmers have substituted tractors for horses on many farms, and nearly all now own combines which lessen the expense of harvest. The effort is to hire as little labor as possible to cheapen the cost of production. In 1928 on the Palouse soil and contiguous areas of other soils, were approximately 3,000 acres of winter wheat, 2,900 acres of spring wheat, and 2,800 acres of summer fallow. Farm buildings were substantial and well kept. An average wheat farmer handled 320 to 400 acres, about two-thirds of which is in crop each year.

Farms in the scablands were in 1928 from 80 to 720 acres in size, excepting one 1,520-acre farm that includes both Palouse soil and scab-

land. Many small plots were abandoned or worked by neighbors. Out of 44 homesteads, 10 were vacant. The area of scabland in Cheney township being about 12,800 acres, the 34 farm families handle an average of nearly 380 acres apiece. The cultivated and hay land per farm usually runs between 20 to 60 acres, and exceeds 100 acres on only four farms. The balance of the scabland farms consists of pasture and timber, the latter providing additional scanty pasturage. The small, irregular plots of ground make hay harvest and crop raising more expensive than under more favorable circumstances, and limit the winter feed and hence the carrying capacity. A typical scabland dweller in the timbered areas is a dairyman who keeps a dozen cows on a farm of 380 acres with 40 to 50 acres of land in timothy and grain hay, and who adds to his income by selling firewood in the winter. Buildings vary from very good to poor. There are three chief types of scabland farmers: (1) successful dairymen, with plenty of hay and pasture land and modern equipment; (2) holdover timothy hay farmers, who wish to sell their farms since the decay of hay farming, but having been unable to do so to advantage are trying to make a living, usually by dairying until they can sell; (3) incompetent and less successful farmers who have to content themselves with scant living on a poor dairy farm. Swine and poultry are kept on most dairy farms and supplement the income to a degree.

In the drier scablands towards the Columbia Basin southwest of Cheney, dairying is a minor industry, merely supplying the demand from the nearby local market towns. The leading industry is stock raising, and the stockmen are of two types: (1) the large scale operator who has adequate pasture, hay, and water and enjoys a good income; and (2) the small stockman, often a man trying to retain a homestead on which wheat farming has failed, who lacking pasture and hay, struggles along with an income too small for a decent living. In comparison with fertile upland areas used for wheat, the desert and semi-arid scablands used for stock raising, support only a small population.

In the moister scablands used for dairying, the density of population in 1928 was about the same as in nearby wheat regions, but because of the low income of many scabland farmers, consolidation of scabland farms into large efficient units with resulting loss of population will be necessary, if the inhabitants maintain a high standard of living. Otherwise, the character of the scabland dwellers must deteriorate if the population remains stationary owing to emigration of the virile elements who will not live on low standards.

GEOGRAPHIC REGIONS OF SIERRA LEONE

G. T. Renner
Geographer, University of Washington

SIERRA LEONE is a little enclave of British territory on the Guinea Coast of Africa, tucked in between French Guinea and the Negro republic of Liberia. Although Sierra Leone is approximately the size of Maine or Ireland, not more than 550 square miles of area are included in the colony proper, the balance of the 27,300 square miles constituting a protectorate attached to the colony. Perhaps no other area of similar size and importance in the British Empire is as little known to the world at large as is Sierra Leone. But, a close examination shows that this country possesses not only a fascinating history, but an interesting diversity in its regional geography as well.

Settlement and Growth

The English first became active along the coast of Sierra Leone during the middle of the sixteenth century, Sir John Hawkins who, in 1562, carried off 300 negroes for sale to the Spaniards in Haiti, being one of the first visitors. In 1618, England began a regular trade on the Guinea Coast, the government issuing charters from time to time after that date to various trading companies. From 1713 to 1786, Sierra Leone served as a slave depot for the Royal African Company which was engaged in supplying slaves to the West Indies. In some years nearly 60,000 slaves went through this depot, and nearly 300,000 were exported during the 20 years from 1713–1733.

In 1786, the rocky little peninsula on the Sierra Leone Coast was purchased by English philanthropists as a place to which freed slaves might be sent, and in that same year 411 freed slaves were sent out from England to settle here. In 1791, nearly 1,200 negroes were brought from Nova Scotia—Negro "Tories" from the American Colonies who had served with the British troops during the Revolutionary War, and who had been subsequently rewarded by land grants in Nova Scotia. The Nova Scotian climate, however, proved too rigorous for them, so they were willing to emigrate to West Africa. This group founded Freetown, now capital of the colony. Later their numbers were augmented by 550 Jamaican maroons. For several years these settlers not only underwent terrible hardships but were many times attacked by unfriendly natives. When Great Britain abolished the West African slave trade in 1807, the population of the Sierra Leone settlements numbered scarcely one thousand. As part of the program for the abolition of the slave trade, Great Britain, in 1808, annexed as a crown colony the areas in Sierra Leone which had been purchased from the native tribes. After its annexation the population of Sierra Leone grew rapidly, for it immediately became the collecting point for all freed or escaped slaves in West Africa or for illicit cargoes of slaves captured by the British navy. By 1811, the population was nearly 2,000, and by

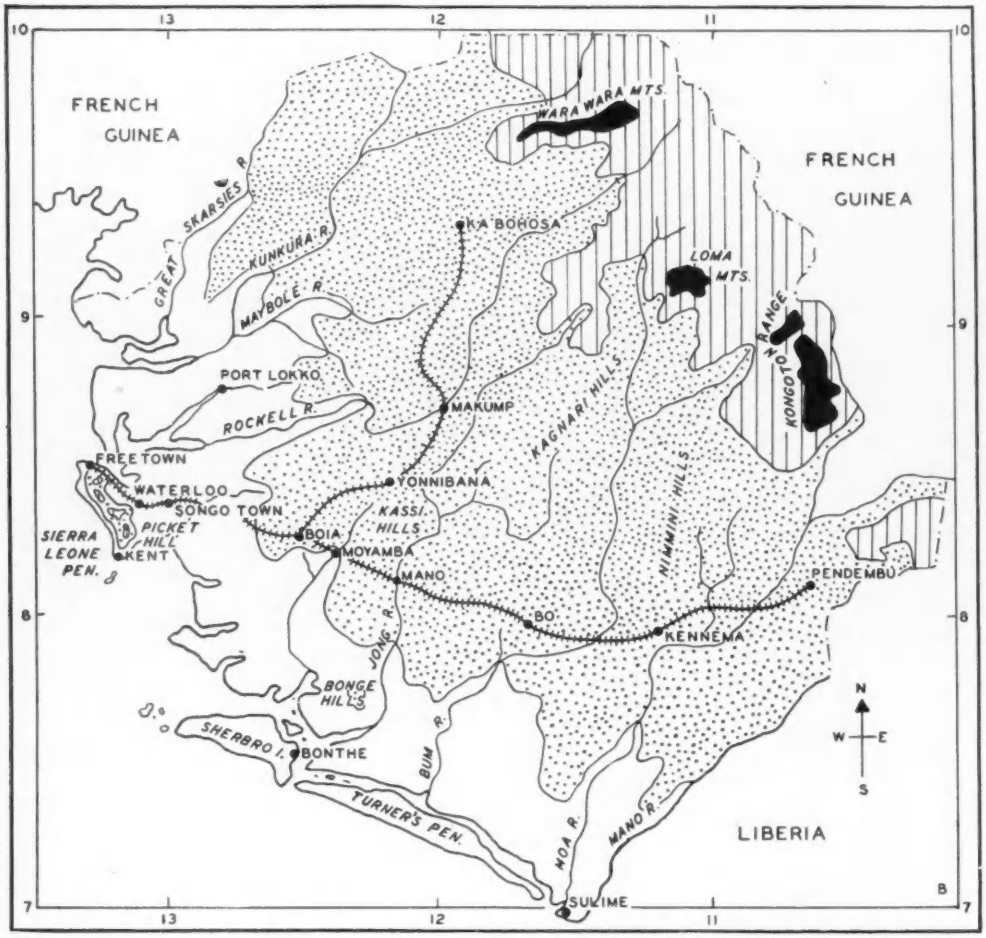

FIGURE 1.—General reference map of Sierra Leone—a little enclave of British territory on the Guinea coast of Africa.

1814, approximately 5,520. In 1815, about 40 freed slaves arrived from the United States and, in 1819, nearly 100 Negro insurgents were transported from Barbadoes. For several decades the population grew slowly until in 1850 it numbered about 17,000. By 1890 the population exceeded 30,000. In 1896, the interior lands between the Mano and the Great Skarsies Rivers were organized into a protectorate and attached to the colony of Sierra Leone. Railway building began in 1899 as the first step toward consolidation and development of the country. The last census (1921) showed the following population for Sierra Leone: The Colony, 85,163; the Protectorate, 1,450,903; Total, 1,536,066.

Out of the 85,163 people in the colony proper, not more than 30,000 are Creoles or descendants of freed slaves, and less than 1,000 are resident whites. The rest are the descendants of the original inhabitants or are immigrants from the protected hinterland.

GEOGRAPHIC REGIONS

Sierra Leone is a compact little country and in its major environ-

FIGURE 2.—One of the market centers of Freetown, the capital and largest city of Sierra Leone. Freetown boasts a railroad, street lamps, and a public market. (Courtesy of Keystone View Company.)

mental aspects is somewhat uniform throughout. Nevertheless, it manifests locally, striking enough differences in both natural environment and human life to warrant the recognition of at least three geographic regions, viz., (a) The Coastal Bush Region, (b) the Central Forest Region, and (c) the Interior Savanna Region.

COASTAL BUSH REGION

The Coastal Region is a narrow strip of land, 10 to 40 miles wide. In the main it is low lying and level, crossed by nine large streams, intersected by estuaries and dotted by lakes and swamps. For half its length the coast is fringed by low barrier islands separated from the mainland by shallow lagoons. In addition, the Banana Islands, Turtle Islands, and several other small groups lie some distance off shore. The one exception to these general lowland conditions is the Sierra Leone Peninsula, where the country is composed of wooded hills, rising in one instance to an elevation of 2,494 feet. The climate of the coastal region is hot, humid, and rather unhealthful.

In type, this climate may be classified as the wetter phase of the Tropical Wet-and-Dry Climate, the average annual rainfall at Freetown being nearly 165 inches, while the average annual temperature is 88° F. (max.) and 72° F. (min.). From March to December the Guinea Monsoon blows from the west, bringing abundant rain. The two months of July and August combined (during which the monsoon reaches its maximum vigor) receive an average rainfall of 65 inches. On the other hand, January and February are almost rainless, for during these months the Harmattan or dry Saharan Monsoon blows from the east.

As a result of the high temperatures, the heavy rainfall, and the shortness of the dry season, the region

was originally covered with rain forest, but this has largely been destroyed by native farming and replaced by bush and jungle. Indeed, almost the entire region back of the mangrove forests, which fringe the lagoons and estuaries, may be described as bush land.

The inhabitants of the coastal region, other than the 30,000 Creoles, are, in the main, Sherbros and Temnes, with lesser numbers of Krims and Veis, and total probably 250,000 all told. By far the greater number of these are village and country dwellers, for Freetown, Bonthe, Waterloo, and the smaller towns along the southern part of the coast contain not more than one-third of the population of the Coastal Region.

The dominant economic adjustment which the natives have made to their environment is along agricultural lines, but the system of culture involved is indeed a careless one. A native farm is made by clearing a space in the bush near the village. During the short dry season the débris is burned and the ashes scattered. Planting is done shortly before the rains commence and subsequent care is reduced to a minimum. After one crop is obtained, the land is, in many cases, abandoned. Millet, cassava, and sesame are widely grown, and hill rice has been cultivated on the dry land of the interstream areas since time immemorial. The soils in a few spots are wonderfully fertile, the alluvium of the mangrove swamps yielding extraordinary crops of wet rice. Most of this wet rice is produced on the alluvial areas of the Port Lokko and Skarsies districts, but is gradually spreading to the southern coastal areas. Some varieties of this wet rice are doubtless indigenous to the region, but it is known that the early missionaries introduced white American rice. Cotton is commonly grown for native weaving and fruits and vegetables for local consumption.

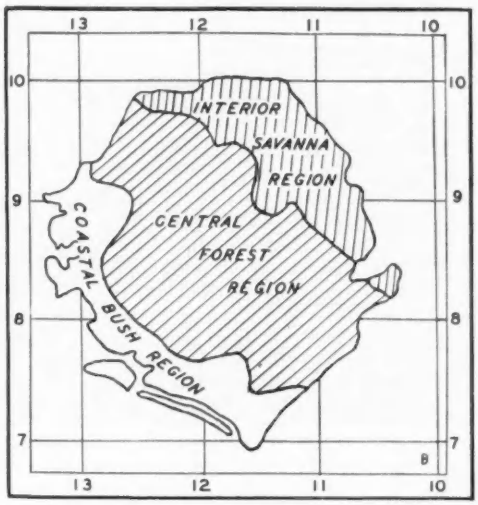

FIGURE 3.—It may be seen from the above map that although Sierra Leone is a compact little country, it contains three major geographic regions.

There seems to be some indication of a systematic plantation agriculture, based on marketable staples, being worked out in this region. Some Ceara and Hevea rubber has been planted, but the attempts have not been very successful. Following the lead of Southern Nigeria and the Gold Coast, extensive cacao plantations have been created along the southern coast, but apparently the climate is not very suitable for cacao. However, the cultivation of cacao is being increased there, and government nurseries are to be found in most of the villages. The fact that in 1927 some 77 tons of cacao were exported indicates that the venture may finally succeed. Coconut and pineapple planting along the coast likewise seems to offer some promise of success, but commercial cotton

planting has been practically abandoned because of the havoc wrought upon that crop by the hot harmattan winds.

The forest, which, in some near-by lands, is so important as a basis of economic activity, is of minor significance in this region. To be sure, bananas, pawpaws, oranges, and limes grow in a wild or semi-wild state and are universally exploited, but they have no commercial significance. The cam wood trees yield a fine red dye and great quantities of this dye wood were exported during the war. But, the post-war competition of German aniline dye has completely annihilated this trade. Formerly, wild rubber (from the Landolphia vine) and gum copal were obtained from the forest, but owing to the reckless exploitation of the sources of these items, little of either is now produced. On the other hand, the piassava fibre (from the bamboo palm) is the best in quality in West Africa and is gathered and exported in considerable quantities. Even good building material is becoming so scarce that the government is establishing forest preserves.

The lagoons and estuaries are visited by immense schools of fish, and tarpon, mullet, bunga, skate, and several other varieties are caught by the fishermen of the littoral. One trawler is engaged in commercial fishing. Most of the fish caught are consumed locally but some are salted, dried, and sent into the interior.

At one time the household industries were in a flourishing condition in the Coastal Region of Sierra Leone, but contact with incoming manufactures is fast destroying native handicraft. A little weaving and dying of native cloth, smelting and forging of iron, and making of pottery is still done, but these are rapidly disappearing.

Subsistence agriculture will always be important in this region, for the bulk of the population will have to be fed locally. But, the economic future must depend upon the development of the production of staple commodities under a commercial plantation system. No great difficulties will be experienced in getting these commodities out to market, for the region is rather adequately served by rivers which are navigable from 20 to 40 miles inland by iight boats and launches. In addition, the railway from the interior crosses the central part. Much experimentation, however, must be done in order to determine what crops are suitable to the climatic and labor conditions which exist.

FIGURE 4.—A characteristic view of bush or scrubland in coastal Sierra Leone. (Courtesy of Keystone View Company.)

CENTRAL FOREST REGION

From the ninth parallel of latitude southward to the Coastal Region, the country is an undulating plain, sloping toward the sea and broken by

FIGURE 5.—A grove of pawpaws. This delicious African fruit helps to make life easier in Sierra Leone. (Courtesy of L. A. Roy.)

isolated hills and ridges. The climate is apparently less bad than in the Coastal Region, but is rainy enough to support a heavy forest flora. Indeed, the most of the central portion of the Sierra Leone is covered with a dense, evergreen, tropical rain forest. Much of the soil is red laterite or light loam of several varieties. In places where the rain forest has been cleared, soil erosion is a serious problem.

The natives of the Central Forest Region are chiefly Mendis, Temnes, and Kissis and are, in the main, hardy, cheerful, and industrious people. The population, which numbers about 900,000, is largely concentrated in villages containing from fifty to several hundred people. These villages are peopled almost entirely by farmers, and their sites are invariably selected because of nearness to good agricultural land. New villages are constantly being made, quite large ones having recently developed along the railway. Incidentally, this railway is unquestionably the most important single item in the Central Forest Region. The main line from Freetown runs for 230 miles eastward almost to the Liberian border, while a branch line extends for 104 miles northeastward into the chief area of oil palm forests. Hard-surfaced feeder roads converge upon the more important railway stations—Moyamba, Bo, Blama, Hangha, Pendembu, Kennema, and Segbwima. In addition, there are perhaps 1,000 miles of dirt roads, fairly good in dry weather but bad in the rainy season. Transportation on the roads is by bullock wagon, revolving casks, or, occasionally, by motor truck.

The railroad has stimulated the growth of this region in both agriculture and nemoriculture. The latter in Sierra Leone consists mainly of the extraction of oil and kernels for export from the oil palms which exist in great numbers in the forest. Unfortunately, great quantities of oil palm trees are being destroyed to make room for rice farms. Rice culture is apparently spreading rapidly into the inland swamp areas under government encouragement and distribution of free seed. The government is fostering cotton growing also by distributing quantities of American cotton seed. In fact, the colonial government is actively encouraging all lines of agricultural industry. Through its agricultural department (started in 1912) an experimental farm is maintained near Mano, where the natives are taught rotation of crops, manuring, better hoeing methods and other much-needed practices. In addition to field crops, small groves or orchards of kola trees occur in nearly every village. From these a very large export of kola nuts goes to Mohammedan Africa. Large as this export is, were better methods of growing and marketing employed, it might be enormously increased.

Another industry giving promise of future development is the extraction of thymol from the omnipresent wild

"bush tea" of Sierra Leone. The industry which perhaps gives the most promise of success in this region is the growing of ginger. It originated in the Orient but was probably introduced into Sierra Leone by ex-slaves from Jamaica. At first, it was grown only in the Coastal Section, but is now confined mainly to the Central Region, where it is universally grown. The poor and careless methods of preparation result in low prices and often loss of markets. In 1926 some 55,000 cwt. of ginger (valued at £76,000) was exported, while in 1927 only 27,000 cwt. (valued at less than £26,000) was marketed. At the recent empire exposition at Wembly, Sierra Leone featured her ginger industry in the hope of stimulating intra-empire trade in that commodity. Particularly is Sierra Leone anxious to supply ginger to the Canadian manufacturers of ginger ale and to receive in return Canadian dairy products. This desirable arrangement will, however, never materialize until Sierra Leone achieves some measure of standardization in quality of its exported ginger.

FIGURE 6.—Drying a crop of cacao in coastal Sierra Leone. (Courtesy of L. A. Roy.)

INTERIOR SAVANNA REGION

The country north of the ninth parallel of latitude is a confused mass of hills and grassy plateaus whose altitude varies between 800 and 3,000 feet. The soils are mostly derived from disintegrated gneisses and granites, and are usually of low fertility. Owing to the higher elevation the climate of this region is much better than that of the Central and Coastal parts of Sierra Leone; the rainy season is lighter and of shorter duration, the humidity is less and the temperatures somewhat lower. Savannas, or open, park-like forests, cover most of this region,—great expanses of tall grass interspersed with low deciduous trees.

The inhabitants, who number about 300,000, are engaged in both agricultural and pastoral pursuits. The Konnos and Korankos, who are most numerous, are confined mostly to the more mountainous areas and are predominantly agricultural. The Fuhlani, Mandingoes, and Susus, on the other hand, are dominantly pastoral and prefer the more open country. Of these the Fuhlani alone (who racially possess some Semitic blood) are really skilled cattle raisers. Small red-brown cattle are bred throughout northern Sierra Leone, but their quality is very poor. A few horses are raised, but the tsetse fly hinders their increase in many districts. Goats and wire-haired sheep are to be found in practically every village.

Agriculture in the interior Savanna Region is based chiefly upon millet, maize, and guinea corn. In addition some sisal, hemp, coffee, and castor beans are raised. In the Koinadugu district, in the northeastern part of the protectorate, large quantities of peanuts are raised, and the cultivation of this crop is gradually spreading. This crop would appear to offer great promise in the agricultural

development of this region for the peanut is admirably adapted to the climatic factors in operation here and might furnish a large export in addition to playing an important part in native subsistence economy.

FIGURE 7.—A good example of native architecture in the central forest region. A school for the sons of native chiefs at Bo. (Courtesy of Phelps-Stokes Fund.)

Travel in the Northern Savanna Region is invariably by trail or bush track and transportation is furnished solely by native carriers. It is no wonder then that this region is but little known and exports practically nothing save a few hides and skins.

SIERRA LEONE'S TRADE

The human factor has been from the start the most important deterrent to the commercial development of Sierra Leone. From 1808 to 1875 the newly liberated slaves were given too much liberty and a period of shameless and unrestricted vice ensued. At the same time the natives of the hinterland were openly hostile. From 1875 to 1894, missionaries and traders undertook the development of the country. A lively export of palm oil and palm kernels to Hamburg and Liverpool resulted. In return, the United Kingdom and Germany sent gin, cotton goods, hardware, and the like to Sierra Leone. At this time Sierra Leone was commonly called "the white man's grave." In 1887 the entire colony and protectorate yielded but £60,000 of revenue. Since 1894, systematic development has been carried on. The first narrow gauge railway was surveyed in 1894 and 1895.

The oil palm belts are large in Sierra Leone and could yield incalculable amounts of oil and kernels, most of which now rot. The best palm areas were formerly inaccessible, so between 1896 and 1899 the colonial government boldly built railways and feeder roads back into the forest to bring out the products. By 1897 the revenue from the colony was double that of 1887. At the present date Sierra Leone possesses 356 miles of railway, including a very steep line from Freetown to the mountains behind the city. Traders and white officials are thus enabled to commute from the hot lowlands to cool upland homes. The colony now yields nearly £900,000 of revenue annually. The exports from the colony in 1927 were as follows:

Article	*Quantity in tons*	*Value in £*
Palm kernels	65,436	1,077,450
Kola nuts	4,461	268,000
Palm oil	3,609	98,000
Ginger	1,367	25,981
Piassava	2,415	....
Rice	162	....
Benniseed	141	....
Cacao (raw)	77	....
Pepper	32	....
Hides	7	....

The palm oil and kernels go mainly to the United Kingdom and Germany; the ginger to the United Kingdom, United States, and Canada; and the kola nuts to Nigeria, Senegal, and Gambia.

The imports consist chiefly of manufactured goods, foods, drink,

tobacco, and goods for developmental purposes. By far the bulk of these come from the United Kingdom but lesser amounts are supplied by Holland, Germany, United States, and France.

ECONOMIC FUTURE

As late as 1923, the Annual Colonial Report stated that while Sierra Leone had been examined by a geologist, no minerals of any commercial value had been found. However, a rather careful survey in 1926 resulted in the discovery in the Marampa section of valuable deposits of hematite. It was estimated that 7 million tons of low phosphorus—low sulphur ore which would run 61% Fe.—was in sight, with a strong likelihood of 20 to 50 million additional tons of fairly good ore in existence there.

In addition, the protectorate possesses great resources in water power. As a result, some manufactural and saxicultural adjustments may ultimately be made. But, the secret of economic success here, as elsewhere in the tropical lands of Africa, lies in inducing the natives to work so as to exploit the natural wealth of forest and soil. If this can be done, Sierra Leone can produce large quantities of key raw materials. The Interior Savanna Region can contribute peanuts and animal products; the Central Forest Region, palm oil and kernels, ginger, and cotton; and the Coastal Bush Region, cacao, rice, piassava, and possibly rubber and fruits.

THE INDIANA OÖLITIC LIMESTONE INDUSTRY

Stephen S. Visher
Geographer, Indiana University

A SMALL district in Indiana produces about half of the present American output of building-stone and over nine-tenths of the cut building-stone. It is believed to be unsurpassed in output by any foreign building-stone quarry district. Despite the importance of this region, no article concerning it has been published in a geographic journal, nor have the chief geographic features of the industry been discussed elsewhere. The relative importance of the Indiana oölitic limestone industry is, however, strongly affected by geographic conditions.

The industry here discussed is situated in southwest-central Indiana, the quarries being scattered from near Bedford north to a short distance beyond Bloomington, and the chief mills are in these cities, which are about 25 miles apart. Bloomington is 50 miles south-southwest of Indianapolis, which is near the center of the state.

Quarrying and milling is not only the chief industry of the locality, but is one of the chief industries of the state, and gives Indiana leadership among the states in the value of building-stone produced. The average daily shipment is 50 carloads.

In recent years, 5,000,000 to 6,000,000 tons of this stone have been marketed annually, with a value of about $20,000,000 to $25,000,000. The chief types are finished or carved stone, of which about 10,000,000 cubic feet, valued at about $15,000,000, have been recently produced annually, and large blocks, containing about 6,000,000 cubic feet, and valued at the quarries at about $4,000,000. These large blocks are shipped out of the district, and are cut up shortly before being used in distant cities.

Indiana oölitic limestone is used for a variety of purposes, but chiefly for facing or trimming costly buildings. Approximately one-fifth of the output of the building-stone is used for school and university buildings, another fifth in office buildings, and a similar amount in municipal, county, state, and federal buildings. Of the federal buildings, post offices are of especial significance, as most recently built post offices display this stone. Another fifth or more of the stone is used in churches, banks, hospitals, and hotels. Less than one-tenth is used for dwellings, as even in the quarry district, stone is more expensive than brick.

Although this stone is shipped to nearly all American states and Canadian provinces, more than three-fourths is used within about 300 miles of Bloomington, within which distance are Chicago, Detroit, Cleveland, St. Louis, Cincinnati, Indianapolis, Louisville, and Milwaukee, with a combined population (including suburbs) of about 10,000,000. In addition there are within this distance scores of smaller cities, most of which afford markets for this stone. The largest market beyond 300 miles is New York City, which is, indeed, the largest single market for the stone; Chicago is second, and Detroit third.

The district is crossed by, or is near to, a number of important railroads connecting two or more of the large cities. It is also near the center of the eastern half of the United States and recently contained the center of the nation's population.

stone and, after about 1886, the output was considerable. Since about 1900 the use has been national in extent.

The notable increase in the use of Indiana limestone during recent decades is intimately related to the greatly increased use of machinery

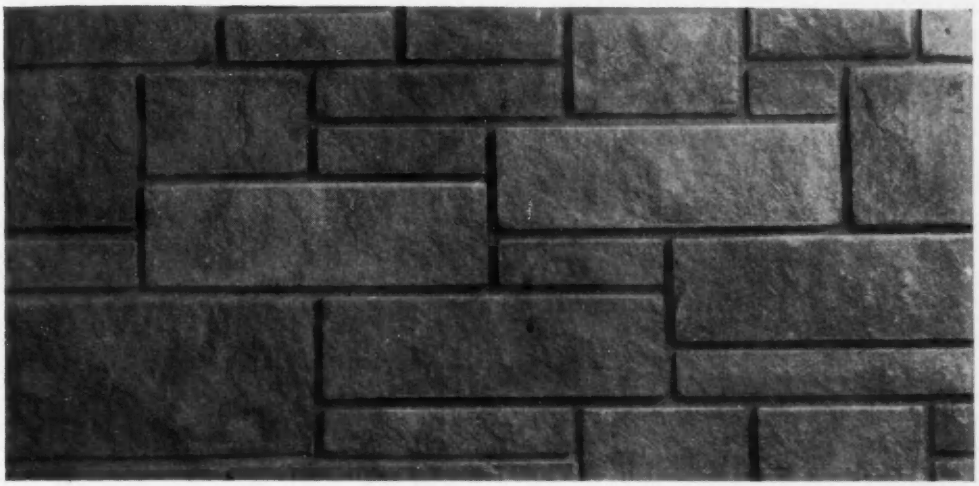

FIGURE 1.—A close view of Indiana oölitic limestone showing its granular structure, resembling sandstone, its uniformity, and lack of bedding planes. The stone here has been prepared by the most recent development in the industry. As many architects and home-builders object to sawed stone, and desire a roughened face, it has been common to chip off, by hand, the outer face of the stone. The high wages paid stone masons has made this quite expensive. Recently, however, a method of splitting the small blocks by the pressure of great shearing blades, has been perfected, and now building stone blocks with the popular roughened outer surface are obtainable at a greatly reduced cost. The blocks illustrated are such blocks. (Courtesy of Bloomington Limestone Co.)

HISTORY OF THE DEVELOPMENT

The probable suitability of this stone for building purposes was recognized a century ago by Dr. Winthrop Foote, of Bedford, a native of New England, who acquired the land upon which many of the most productive quarries were later located. However, until a railroad reached the area in 1852, the use was local and very meagre. Indeed, until the Chicago City Hall was built of Indiana limestone in 1878, the market was slight. The prominence of the Chicago building soon led, however, to a widely increased interest in the

in quarrying and preparing the stone. Formerly, this stone, and all other building stones, were prepared chiefly by hand labor, and then this stone could not compete with the products of various quarries located nearer their markets. But now this stone, which can most readily be prepared by machinery, has a great advantage over more refractory stones. Indiana oölitic limestone is quarried and prepared for use with a minimum of man labor and it also requires, because of its softness when first quarried, a minimum of mechanical power.

Quarrying is very greatly aided by

channelling machines, which move slowly back and forth along a temporary track and cut deep grooves into the limestone with long chisels. After the groove is cut sufficiently deeply at the back and ends, the block of stone is pried off by wedges driven by hand. No explosive is used. The blocks of stone, which commonly

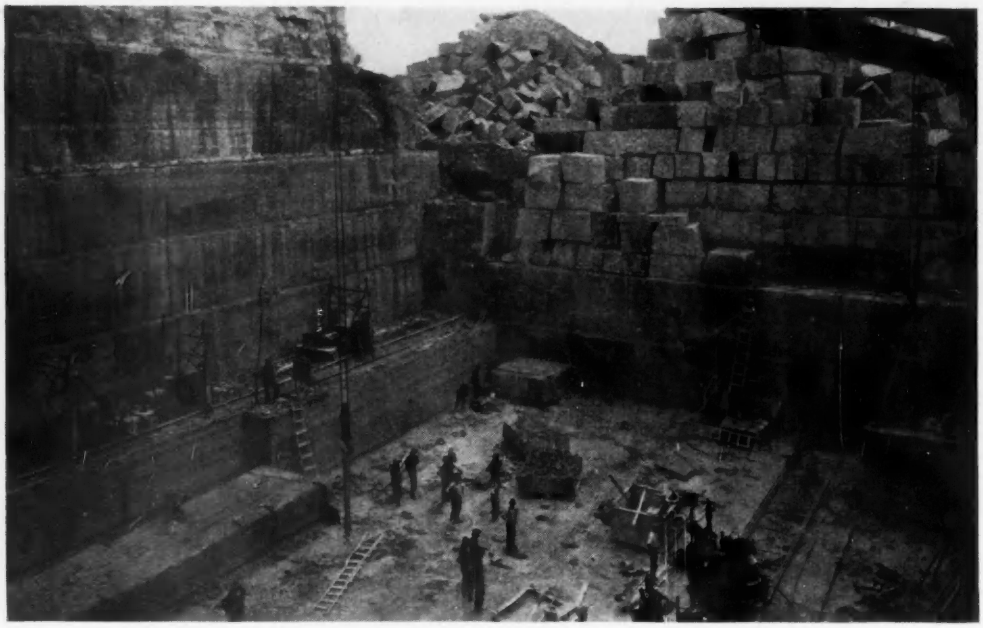

FIGURE 2.—A view in a quarry near Bloomington showing electric channellers at work; recently separated large pieces; piled up smaller and waste pieces.

are about 15 feet long by 6 feet wide, and 8 feet deep, are raised and loaded on railroad flat cars by great derricks. In the mills these blocks are cut up by saws, either gang, diamond, or band. Great mechanical planers are used to help make special shapes, and lathes turn out columns. Such hand work as is required is practically all done by means of pneumatic chisels.

All of the chief items of mechanical equipment used in the Indiana quarries and mills were invented elsewhere, most of it in the marble district of Rutland, Vermont, but partly in Scotland. Until recently, much of the equipment, aside from the electric motors, came from Rutland, Vermont, but an increasing amount has been manufactured at New Albany, Indiana, and especially at Bedford. At present, the Bedford Foundry and Machine Company supplies a large share of the new equipment.

LABOR

Approximately 5,000 men are now employed in the quarries and mills, but the number was almost as great in 1909, when machinery was less extensively used. There have, however, been significant changes in the types of laborers. Wages now are much higher than formerly, and few foreigners are now employed, whereas twenty years ago a large share of the laborers were foreign born.

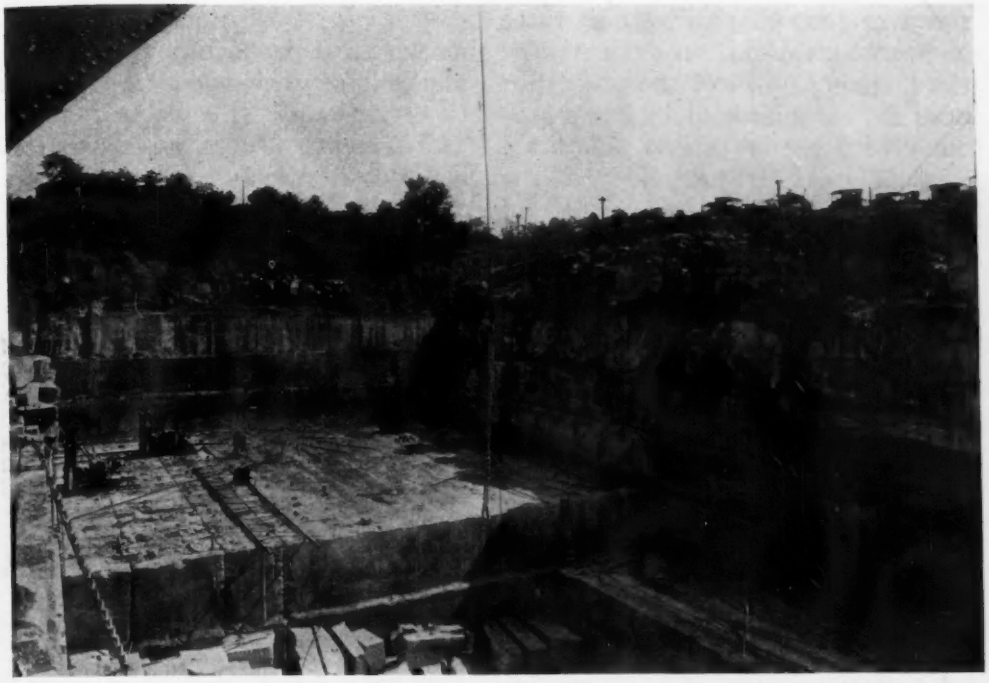

FIGURE 3.—Another quarry view showing massive oölitic limestone underlying inferior stone; autos of quarry workers; channellers at work.

CHANGES IN SCALE OF OPERATION

Before about 1900 most of the quarry and milling companies were small; several of them were organized primarily to furnish stone for a single large public building and were continued on only a half-hearted basis, if at all, after the completion of the contract. But, the size and permanence of the large companies increased progressively until in 1925 twenty-four of the concerns, including the largest, were merged into the Indiana Limestone Company, with quarry assets of $30,000,000 and mills valued at $10,000,000. This company owned, in 1926, 200 channelling machines, 191 derricks, 101 travelling cranes, 287 planers, 243 gang saws, 110 diamond saws, and 43 lathes. In 1928, a dozen other quarries and several mills were combined into the Bloomington Limestone Company. Some of the advantages of these mergers have been a more effective use of expensive equipment, and of unusual types of stone, and of by-products formerly wasted, such as inferior stone, pulverized stone, and material removed in opening the quarries. An important advantage has been in carrying on a more effective advertising campaign. The mergers have also had a great advantage over the smaller companies in complying with the time requirements of some rapidly built structures. No single quarry and mill can supply stone as rapidly as it is desired in the erection of large office buildings.

The industry is affected not only by its favorable location in respect to diversified markets and railway transportation but also by other geographic influences, notably climate and local relief. Winter cold

prevents quarrying during only three or four months and does not require the shutting down of the mills, nor does the summer heat interfere seriously with the industry. The limestone district is just beyond the margin of the glaciated region of northeastern United States. Hence, it has no heavy overburden of glacial material, requiring removal. The moderate relief aids quarry drainage and the disposal of wastage. The hilliness and generally poor soil of the locality reduces the value of the land for agriculture and hence cheapens it. The relief is not great enough, however, to interfere seriously with railroad construction. Indeed, the limestone belt is somewhat less rugged than the tracts adjoining to the east and west, which condition led to the location along it of the chief north-south railway of the area (the Monon). The development on this line of Bedford and Bloomington, which were small cities before the stone industry commenced, was also related to the local topography. Bloomington is at the divide between the two main streams of south-central Indiana, branches of the White River, while Bedford is in the valley of the southern fork of the White River. Both are in relatively large areas of comparatively gently rolling topography. Bedford is near the main line of the Baltimore and Ohio Railroad between Cincinnati and St. Louis, built before quarrying was significant, and Bloomington on the Illinois Central line to Indianapolis.

COMPETITIVE PHASES: COMPARATIVE ADVANTAGES

The use of any natural resources, such as a deposit of ore, coal, or stone, is by no means wholly controlled by its location in respect to means of transportation, potential markets or by other geographic conditions affecting the deposit itself. The extent of use of a particular deposit often depends far more

FIGURE 4.—An abandoned quarry filled with water, and stacks of stone recently removed from quarry just beyond. These are to be cut up later.

largely upon the character and advantages of the competing deposits. This is recognized by many persons, but often is overlooked. Many geographers seem to feel that they have done enough if they have described well the geographic conditions directly affecting the industry or resource dealt with. The Indiana oölitic limestone industry may serve as an illustration of the inadequacy of a description of the local conditions without regard to those in competing industries. Unquestionably, this stone is not ideally located nor ideal in its physical characteristics. A location close to one of the Great Lakes, a readily navigable river, or the sea would be more favorable to its extensive utilization, as would a location right near a great city, such as Chicago. Similarly, it would find a greater market if the stone were lighter, less brittle, and less affected by atmospheric conditions.

Geographic conditions not being ideal nor the stone possessed of ideal qualities, the extent of its utilization is conditioned by the relative advantages of competing quarry districts. If some other district had corresponding geographic advantages and a better stone, or superior geographic advantages and a stone not too much inferior to the Indiana stone, the development of the Indiana limestone industry would have been retarded or largely prevented. Hence, every comprehensive discussion of the geography of an industry or region should consider the relative advantages of the resource, industry, or region described as compared with those of the competitors.

The comparative advantages possessed by the Bedford-Bloomington quarry district in respect to climate have been already suggested; reference has been made also to the fact that this district lacks the extensive overburden of glacial drift encountered in many competing quarries. Another comparative advantage is the relative cheapness of the raw land, due in large part to the comparatively poor soil and somewhat hilly topography related to the fact that this district was not glaciated. The district's location in respect to the center of population and certain thriving cities was given, but no hint was made of the significant fact that there are relatively few quarries in this general region that are much better located in respect to cities and transportation facilities than are those in the Bedford-Bloomington district. This is largely because this general region possesses, characteristically, a thick overburden of glacial drift, hiding and making relatively unavailable the stone. The general levelness works in the same direction.

Thus in these significant geographic respects, the Bedford-Bloomington district is comparatively fortunate. But, the great development of the stone industry of this district depends largely on the comparative advantages which it possesses in respect to the cheapness of quarrying and of preparing the stone for use.

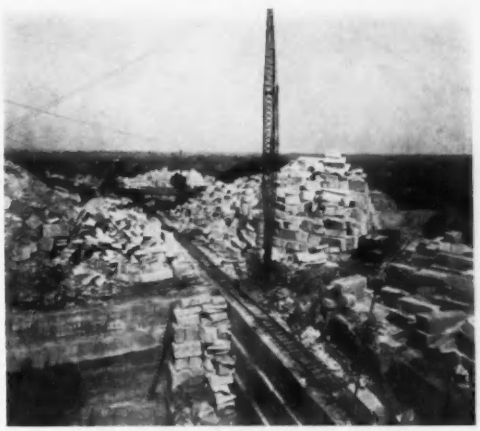

FIGURE 5.—A view in the quarry district, showing something of the region.

QUALITY OF THE STONE

The Indiana oölitic limestone is found locally in massive formation, cracks and seams being relatively few, wherever this stone is overlaid by a protecting layer of other limestone of sufficient thickness. In many of the quarries there are unbroken masses of rock many feet in depth and breadth. Elsewhere, such large masses of uncracked rock are very rare indeed. In most of the world's quarries there are so many cracks, bedding planes, and joints, that it is hard to obtain blocks suitable for building purposes without having to remove and discard many smaller or irregularly shaped blocks which are not suitable. In very few quarries, indeed, are there homo-

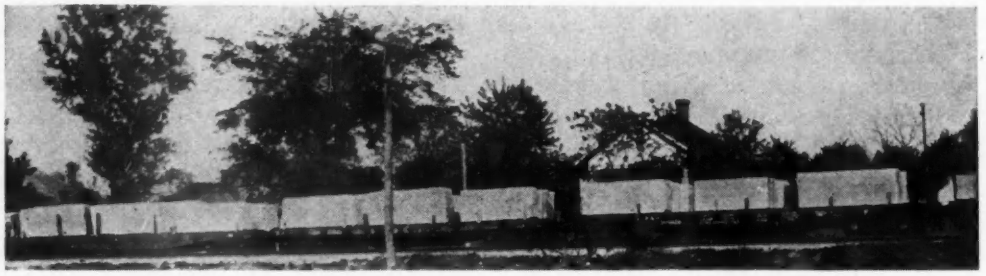

FIGURE 6.—A trainload of Indiana limestone on its way from the quarry to the mill.

geneous masses of rock large enough to be cut into a train load of first-class building stone. But, in the Bedford-Bloomington district, such masses are not rare.

Not only are large masses of stone without a crack disclosed in each of the better quarries, but the stone also has approximately the same texture and color in most of the quarries. Hence, buyers are not dependent upon a particular quarry for their stone, and, when desirable, many quarries can and do coöperate to supply quickly large shipments of stone. Furthermore, an institution such as the University of Chicago or the Massachusetts Institute of Technology can safely plan to use this stone in the erection of numerous buildings, for there is no likelihood that the supply of stone of the desired quality will be so depleted that quarrying costs will become prohibitive before the buildings are all erected. Yet, in different quarries, and in some individual quarries, slightly different colors are represented so that a variety of shades may be obtained at any time, if desired. Very few quarry districts in the world surpass the Bedford-Bloomington district in these significant respects.

Another great advantage possessed by Indiana oölitic limestone is its "softness" when first quarried. It can then be sawed readily into blocks of desired sizes and shapes and even cut by lathes into pillars and planed by giant planes so as to form fluted columns and many other designs. Although this stone is at first cut very much more easily than other valuable building stone, which greatly cheapens its quarrying and preparation, nevertheless soon after being exposed to the air, it seasons and becomes distinctly hard on the outside, and strong enough throughout so that it can be used safely in the walls of even the largest buildings. This hardening is due to chemical changes which take place, chiefly to the disposition of silica around the exterior granules. The silica of "green" stone is in colloidal solution between the limestone granules.

The softness when first quarried, and the subsequent hardening, gives Indiana oölitic limestone a tremendous advantage over most competing stones. To be sure, marble and the Berea sandstones of Ohio are now sawed, but at a very much greater expense, and the sawing of granite is so costly as to make it almost prohibitive for extensive use in buildings. Most limestones contain enough hard chert nodules to prevent economical sawing, or are dolomitic, and hence much harder to cut than the oölitic stone.

SOME INFLUENCES OF THE INDUSTRY ON THE LOCAL GEOGRAPHY

The oölitic limestone industry has enabled the population to increase notably in this region while it has decreased sharply in almost all other parts of the unglaciated region of Indiana. The population supported by the stone industry affords a considerable market for local agricultural products, thus stimulating certain phases of agriculture, dairying, fruit-growing, and egg-production, for example. Agriculture is affected adversely, however, by the abandonment of the fields of former farms purchased by the stone companies. Although only a small part of a farm may be underlain by valuable stone, ordinarily the entire farm is purchased, so that free access may be had to the valuable hill. The stone companies make no effort to use or rent agricultural lands, however, and there has been a considerable reduction in tilled acreage in the limestone belt.

The stone industry has affected not only the density of the population, but also its distribution. Most of the workers in the mills live in Bloomington or Bedford, and go to work by auto. The workers in the quarries live partly in these cities, some going to work in company buses or trucks or in private autos, but others by a morning and evening train. A considerable number of workers live, however, near the quarries in dwellings facing the main road, or side roads, near the main road. During the last decade or so, hundreds of such homes have been

FIGURE 7.—A view in a stone mill showing cut stone of various sizes and shapes. (Courtesy of Indiana Limestone Co.)

erected in the limestone belt, or adjacent to it.

The standard of living has been raised by the industry. The quarries and mills use much electricity, and hence electric wires are frequent. As a result, most of even the smaller homes of the workers have electric light. The excellent wages paid by the industry have also helped raise living standards. Many of the companies have supplied coal and stone at cost to their employees, which factor has also helped. Most of the houses in the district have some stone in their foundations, at least, as broken or otherwise imperfect pieces of stone are cheap.

When the mills and quarries were sold to the mergers, sufficient sums were received by a number of men to make them quite wealthy. Many such persons erected expensive residences in Bloomington or Bedford. Bloomington, with the State University and many fine fraternity and sorority houses, obtained a large share of such expensive residences of "stone men." Almost without exception, men who made their fortunes selling out to the mergers built residences of stone.

The stone industry has affected local education in three chief ways. The taxation of the stone lands, quarries, and mills, affords a large revenue, most of which is spent for education. The local demand for skilled workers has led the local high schools to offer courses in stone-cutting, drafting, and in various other phases of work of the industry. Opportunities for work during the summer months in the quarries have enabled a considerable number of youths to continue their university education. But, on the other hand, many local youths who might otherwise have graduated from the university leave school to take remunerative jobs.

The quarries are conspicuous features of the landscape in the limestone district. The great derricks are often visible for miles. The largest quarries have faces more than a mile long, and as nearly all quarries are on hillsides, and the rock is light colored, the quarry walls are often prominent. Many of the quarries are quite deep, and after abandonment, or in winter, many contain 40 to 60 feet of clear water. Such quarry holes are often used as swimming places, and some are stocked with fish and yield, occasionally, large bass. Other effects on the local topography are caused by the numerous short railroads to the scattered quarries, along which cuts are numerous.

In brief, the Indiana oölitic limestone industry is of geographic interest in many ways. Geographic conditions help powerfully to permit the industry to compete successfully with other quarry districts. The industry, in turn, has altered the local geography in significant ways. As there are still vast quantities of excellent stone available, and as no known supplies of rock of comparable quality are better favored geographically, it is likely that the industry has not yet reached its maximum development. The competition of artificial structural materials, especially brick and tile, is increasing, especially at considerable distance, because of the high cost of shipping this stone. But, as there is a huge market within 300 miles of the quarries, and as the price of stone in the district is being reduced by improved methods of preparation, the industry has a bright future.

PEANUTS: PRICES, PRODUCTION, AND FOREIGN TRADE SINCE THE CIVIL WAR

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PEANUTS are believed to have originated in Brazil and according to tradition were introduced into Africa and Europe by early traders, whence they were brought to America during the Colonial slave trading.

History

Just when peanut raising began in this country it is not possible to say, although peanuts are known to have been cultivated in a small portion of southeastern Virginia for many years before the Civil War. The popularity of peanuts among the many soldiers who were in this region during the Civil War is believed to be largely responsible for the rapid dissemination of peanut culture in this country after 1865.

Reports of the Department of Agriculture at that time state that domestic peanut production increased from two hundred to three hundred per cent annually from 1865 to 1870. In 1889, peanut production was reported in 37 states, although 18 of these reported 8 acres or less and only 5 had over 20,000 acres. The same number of states reported peanut production in 1899 with 19 reporting 11 acres or less and 5 having over 20,000 acres. In 1909, 42 states reported, 19 of these having 10 acres or less and 7 having over 20,000 acres. Only 33 states reported in 1919, one-third of which had less than 10 acres and 6 having over 22,000 acres. The situation was practically the same in 1924 with 32 states reporting, 13 of which had less than 10 acres and 6 having over 22,000 acres.

This shows clearly that after the rapid spread of peanut culture following soon after the Civil War, peanut growing has shifted very little in its geographical distribution in this country. Increased production in the United States since 1889 has resulted almost entirely from intensification and increased acreage in Georgia, Alabama, North Carolina, Virginia, and Texas, the five leading states which account for about 85 per cent of the United States production.

As in the case of tobacco production, Virginia was the pioneer and the principal producer for a long time, but was later surpassed by her sister state, North Carolina. The first records we have of peanut acreage and production are for 1889 as recorded in the United States census of 1890. In 1889 there were 204,000 acres of peanuts grown in the United States with a production of 3,558,000 bushels, and Virginia was still far in the lead among the States, producing one-third of the United States total. Peanut acreage increased 253 per cent from 1889 to 1899, with the largest increases of 440 per cent in North Carolina and 588 per cent in Texas, which, however, was of minor importance in 1889. The increase in production during these ten years was 336 per cent or considerably more

than the increase in acreage. While yield per acre and prices indicate that 1899 was a more favorable year than 1889, it seems safe to assume that yields were increased through better practices, although it is probable that some of this increase is made apparent because more peanuts were being harvested in Georgia, Alabama, Florida, and Texas instead of being "hogged off."

FIGURE 1.—Plowing out and pulling out peanuts in Blakely, Georgia, 1918. (Courtesy of Photographic Section, U. S. Bur. of Plant Industry.)

Peanut acreage in the United States increased 68.4 per cent to 870,000 acres from 1899 to 1909. In both 1917 and 1918 we had an unusually large acreage and production with the peak production in 1917 when 1,433,000,000 pounds were harvested for nuts and the peak in acreage in 1918 when 1,865,000 acres were harvested for nuts. Acreage and yield per acre during the past ten years has shown no particular trend up and down and has averaged 1,074,000 acres and about 700 pounds per acre from 1919 to 1928.

The advance of the boll weevil throughout the cotton belt has been largely responsible for the increase in peanut growing in many sections in Texas and particularly in Alabama and Georgia since about 1914. Peanut growing brought prosperity to many of the old cotton sections. The citizens of Enterprise, Alabama, voted $3,000 in 1919 for the erection of a monument to the boll weevil, on which was inscribed:[1] "In profound appreciation of the boll weevil and what it has done as the herald of prosperity, this monument is erected by the citizens of Enterprise, Coffee County, Alabama." Other factors contributing to the expansion of the peanut industry during the World War period were the increased consumption of peanut products, research and investigation by the United States Department of Agriculture, and a recognition of the value of peanuts in a complementary relationship with cotton and tobacco growing.

SOURCES AND DESCRIPTION OF PRICE DATA

Peanut prices were secured in connection with an historical study of prices of all farm products in Virginia, a coöperative study between the Bureau of Agricultural Economics and the Virginia Agricultural Experiment Station.

Newspaper market quotations on peanut prices in Virginia were first recorded in 1857 and may be found in the *Southern Argus* or *Public Ledger* on file at the Norfolk Public Library. Prices for 1857 to 1858 ranged from 60 to 90 cents per bushel, and in 1859 to 1860 the price was somewhat higher, ranging from $1.05 to $1.30 per bushel. Peanut prices were not recorded again in the Virginia newspapers until in December, 1867. Peanut prices were secured

[1] Clay, H. J. and Williams, Paul M., *Marketing Peanuts*. United States Department of Agriculture, Department Bulletin No. 1401, May, 1926, page 2.

FIGURE 2.—Stacking peanuts around poles. Note the cleats nailed a few inches from the ground to keep the vines off the soil.

from market quotations at Norfolk and Petersburg and from commission merchants and local buyers at Norfolk, Petersburg, Suffolk, and Capron. Prices, 1868 to 1902, were also secured from a well-kept diary by the late T. B. Rowland who was known as the father of the peanut industry.

The Virginia type peanuts were sold by the bushel at Norfolk until November, 1879, after which all quotations were on a pound basis. At Petersburg, Virginia, peanuts were quoted on a bushel basis until August, 1884. These prices were converted to cents per pound on the basis of 22 pounds to a bushel. Prices of Virginia peanuts secured from market quotations were for prime peanuts. In the beginning of the period studied, prices sometimes showed considerable variation between Norfolk and Petersburg, especially during the summer months when very few sales were made. Prices from November to March, when about 95 per cent of the peanuts are marketed, were fairly uniform at different markets, and since about 1880 have usually varied within three-eighths of a cent except during periods of rapid price changes as during and after the World War.

Spanish type peanuts have been sold by the bushel throughout the period for which Spanish peanut prices were obtained, 1882 to 1929, and are sold by the 30-pound bushel in Virginia and North Carolina.

Monthly peanut prices have been collected for Virginia by the United States Department of Agriculture since 1910. These prices are based

FIGURE 3.—Field of Virginia Bunch peanuts with posts set for shocking in Scotland Neck, North Carolina. (Courtesy of Photographic Section, U. S. Bur. of Plant Industry.)

on both the Virginia and Spanish types and are somewhat different from the historical prices collected separately for Virginia peanuts. The historical series of Spanish peanut prices was, therefore, continued to 1929 and the historical series of Virginia peanut prices was continued through 1926 and then joined to the

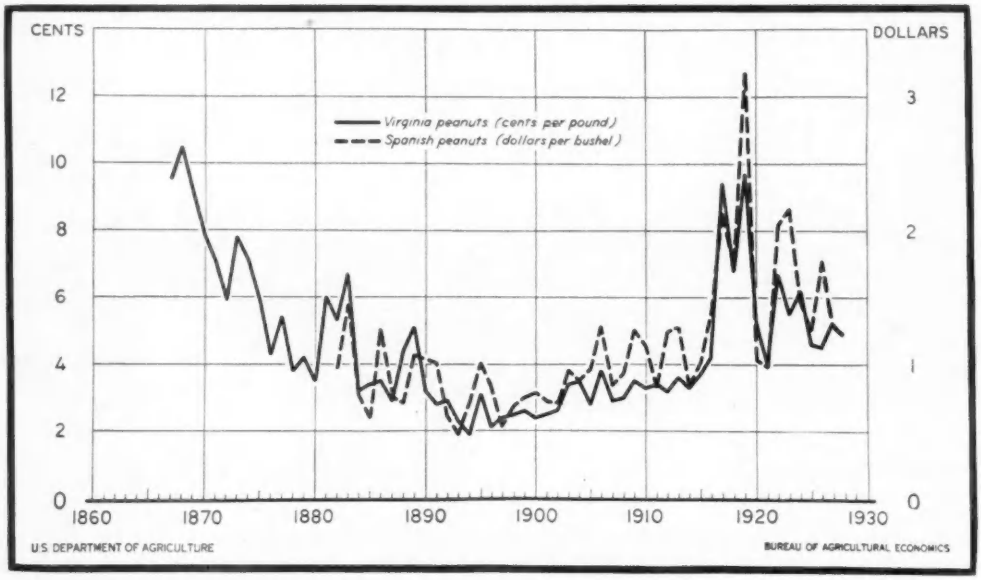

FIGURE 4.—Virginia and Spanish peanuts, average price received by producers in Virginia for the crop year, 1867–1928. (Courtesy of U. S. Bur. of Agric. Econ.)

United States Department of Agriculture series as separate prices were not collected for Virginia peanuts since 1926.

The monthly prices of Virginia and Spanish peanuts were weighted by the estimated monthly marketings during the crop season beginning November, as follows:

ESTIMATED MONTHLY MARKETINGS
(Percentages)

	Virginia Peanuts	Spanish Peanuts
November	20	10
December	30	30
January	25	30
February	15	15
March	5	10
April	2	2
May	1	1
June	1	1
July	1	1
August	..	..
September	..	..
October	..	..
Year	100	100

The marketing season for Spanish peanuts is a little later than for Virginia peanuts, but in both cases, producers market about 95 per cent of their stock by the first of April and dispose of practically all their sale stock by the last of July.

The weighted average price for the crop season beginning November is plotted in Figure 4 from 1867 for Virginia peanuts and from 1882 for Spanish peanuts. It will be observed that there is no constant relationship between the prices of the large Virginia type and the small Spanish type. The prices plotted in Figure 4 are the actual prices received by producers and should not be confused with the deflated prices referred to in the following discussion. About 85 per cent of the peanuts grown in Virginia are of the Virginia type and as this type also makes up the bulk of our peanut imports, the following analysis is based on the long price series for the Virginia type peanuts.

In Figure 5 are plotted the deflated prices of Virginia peanuts along with net imports of peanuts and peanut oil. Deflated prices are prices from which variations due to changes in the value of money have been eliminated by dividing by the index or general level of prices of all

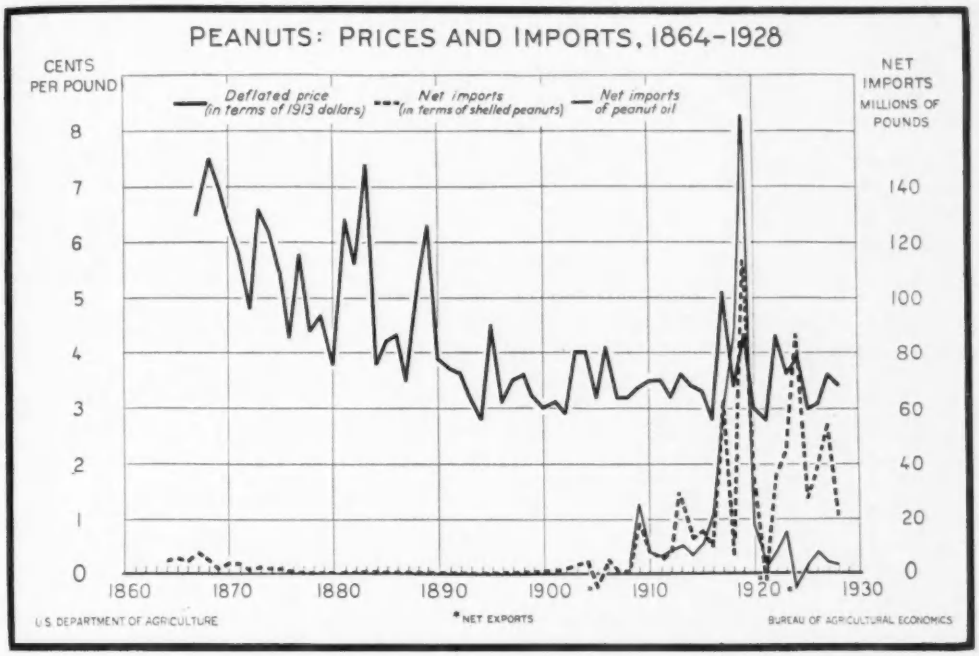

FIGURE 5.—Average price of Virginia peanuts received by producers in Virginia, deflated by the Bureau of Labor Statistics all commodity index. Net imports are for the fiscal year beginning July 1. Three pounds of peanuts not shelled are equivalent to two pounds shelled. (Courtesy of U. S. Bur. of Agric. Econ.)

commodities. These prices reflect variations in prices due to causes other than changes in the general purchasing power of the dollar. These prices 1890 to 1928 were deflated by the Bureau of Labor Statistics All Commodity Index (1913 = 100) after weighting the monthly index numbers from November to July by the same weights as were originally used to weight the monthly prices, and, which, is equivalent to deflating the monthly prices. Monthly index numbers are not available before 1890 and as about 50 per cent of the Virginia peanuts in Virginia are marketed in each of the same and the following calendar year, the average price of peanuts for the crop year was deflated by an average of the annual index number for the same and the succeeding calendar year.

ANALYSIS OF PRICES AND TRADE

The United States has in the past imported varying quantities of peanuts and peanut oil to supply domestic requirements. There have been only two years on record when we have had a net export of peanuts and one year when we had a net export of peanut oil as indicated in Figure 5.

FIGURE 6.—Old method of picking peanuts. Now, this is largely superseded by machine methods.

FIGURE 7.—Separating peanuts from the vines by a power-driven picker. One of these machines will pick several hundred bushels per day.

PEANUT TARIFF HISTORY *

Act of	*Duty on Peanuts*		*Duty on Peanut Oil*
	Shelled	Not Shelled	
June, 1864	1½ cents per pound	1 cent per pound	
August, 1894	20% *ad valorem*	20% *ad valorem*	
July, 1897	1 cent per pound	½ cent per pound	
October, 1913	¾ cent per pound	⅝ cent per pound	6 cents per gallon †
May, 1921	3 cents per pound	3 cents per pound	26 cents per gallon
September, 1922	4 cents per pound	3 cents per pound	4 cents per pound, or about 30 cents per gallon
January, 1929	6 cents per pound ‡	4¼ cents per pound	

* Compiled from a survey of the Tariff Acts passed by the Congress of the United States, 1864–1930.
† Previous duty was 25 per cent *ad valorem*.
‡ Increased to 7 cents per pound in the Act of June, 1930.

FIGURE 8.—Peanut oil; hampers ready for transportation in China. After crushing in simple native mills in China, crude peanut oil is placed in woven wicker hampers lined with several thicknesses of paper which are rendered waterproof by smearing with pig's blood. The hampers are carried by coolies or simple carts to port of export. (Courtesy of Photographic Section, U. S. Bur. of Agric. Econ.)

FIGURE 9.—A set of pictures submitted by J. R. Putnam, Consul at Chefoo, China, with a report—"Production and Marketing of Groundnuts," November 19, 1925, No. 29429, filed in Division of Statistical and Historical Research: (1) peanuts sacked ready for shipment abroad; (2) interior of godown (warehouse) compound; (3) interior of godown compound, sorting and grading; and (4) interior of small godown. (Courtesy of Photographic Section, U. S. Bur. of Agric. Econ.)

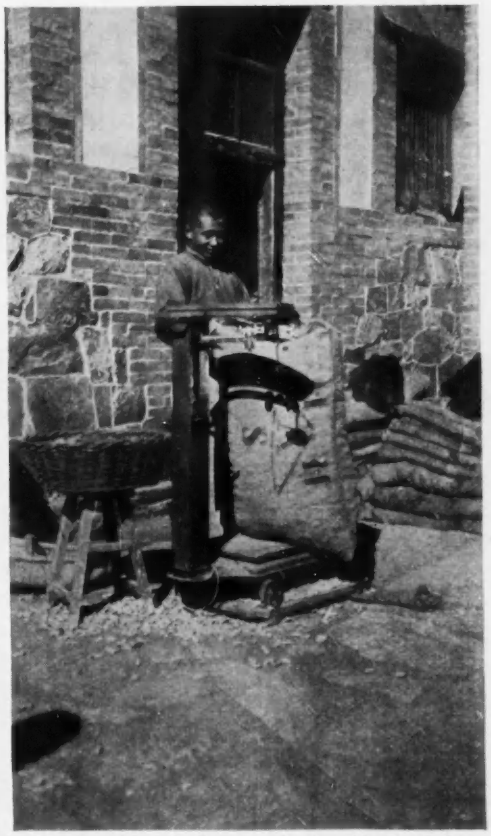

FIGURE 10.—A picture submitted by J. R. Putnam, Consul at Chefoo, China, with a report—"Production and Marketing of Groundnuts," November 19, 1925: weighing bags of nuts for foreign shipment. (Courtesy of Photographic Section, U. S. Bur. of Agric. Econ.)

Because of this, changes in import duties are very important in determining prices, imports, and also production. The table on page 64 records the tariff history on peanuts and peanut oil.

Peanut imports have been recorded in terms of value since July, 1859, but quantities were not recorded until July, 1864, and prices have been secured since November, 1867. Imports were recorded by countries from July, 1864, to June, 1868, but were not reported by countries again until July, 1909.

Apparently the demand for peanuts after the Civil War increased even faster than domestic production and imports were quite large

from 1864 to 1875. Practically all of our peanut imports at this time came from Africa and during the year beginning July, 1867, our imports amounted to over 7,700,000 pounds.

Prices (which in this discussion refer to the deflated prices in Figure 5) reached the highest point on record in 1868 and then declined to 1872, and imports were considerably reduced. Prices and imports increased in 1873, but not until after 1900 were imports again of much significance.

FIGURE 11.—World peanut production: about 92 per cent of the world's peanuts are produced between the equator and 40° north latitude and 8 per cent in the Southern Hemisphere where production extends to about 35° south latitude. About 73 per cent of the world's peanuts are produced in Asia, 18 per cent in Africa, 7 per cent in North America, and 2 per cent in South America. Where soil and climate conditions are favorable to peanut culture, this crop is often cultivated very intensively, especially as peanuts can be grown in sandy soils where other crops offer but little competition. Because of the intensive culture in rather limited areas, it is not possible to represent quantities accurately in the above chart (see accompanying table). With the exception of Chinese exports to the United States and Canada, most of the peanuts entering into international trade are used in the making of peanut oil. (Courtesy of Photographic Section, U. S. Bur. of Agric. Econ.)

Prices fluctuated within a range of 2½ cents per pound from 1874 to 1882, but in 1883 advanced almost to the high point reached in 1868. The next year, 1884, prices dropped sharply, perhaps with a greatly increased production as a result of high prices the previous year. Prices increased in 1888 and 1889. The first census report on peanuts shows that the average yield in the United States in 1889 was only 17.4 bushels per acre, while 27 bushels may be considered as an average of all types for the United States.

Prices declined from 1889 to a low point in 1894 when the duty was changed to 20 per cent *ad valorem* which, at the existing low prices, accounted for a reduction in duty. Prices were higher in 1895, but from 1894 to 1916 were surprisingly uniform, fluctuating within a range of 1.3 cents for 23 years. Production figures except for census years are not available until 1916, but it appears that the lower price in 1905 along with a net export of peanuts for the first time was a result of a large domestic production.

Imports of peanuts and peanut oil

were unusually high during the fiscal year beginning July, 1909. Most of these peanut imports were from Spain and France in response to higher prices for Spanish peanuts. Europe has since become less and less important as a source of our imports, and since 1915 practically all of our peanuts have come from the Orient and at the same time our imports have changed from unshelled to shelled peanuts to enable saving in freight on the long haul from Eastern Asia.

Peanut oil imports were high during the World War period with the increased demand for vegetable oils and reached the enormous figure of 165,000,000 pounds during the fiscal year 1919 to 1920. The domestic production of peanut oil practically ceased that year as a result of the decrease in peanut production and high prices. Spanish peanut prices were so high that many White Spanish peanuts from the southern states, which during and soon after the war had been grown principally for oil, were sold to an increasing extent for salting and the manufacture of peanut butter and candy. The imports of peanut oil have since been relatively small with the big increase in duty in 1921 and in the fiscal year,

WORLD PEANUT PRODUCTION, AVERAGE 1925–1928 *

Continent, Country, State or Province	*Production* 1,000,000 pounds Unshelled
North America:	
United States	
North Carolina	196
Georgia	165
Virginia	135
Alabama	114
Texas	57
Florida	27
Others	57
Mexico	
Puebla	5
Jalisco	4
Guanajuato	4
Others	5
South America:	
Argentina	
Cordoba	72
Santa Fe	26
Entre Rios	26
Chaco	8
Corrientes	6
Buenos Aires	3
Paraguay	20
Uruguay	1
Europe:	
Spain	
Valencia	40
Alicante	4
Castellon	4
Huelva	2
Malaga	2
Asia:	
India	
Madras	3,398
Bombay	1,535
Burma	438
Hyderabad	55
Others (nearby)	55
China †	1,800
Java and Madura ‡	489
Asia—Continued:	
Kwangtung	111
Formosa	65
Japan	28
French India	28
Indo-China	19
Philippine Islands	4
Korea (Chosen)	3
Africa:	
French West Africa	
Senegal	1,023
Sudan	94
Upper Volta	67
Niger Territory	22
Mauritania	3
Nigeria ¶	251
French Equatorial Africa	186
Gambia ¶	136
Madagascar	52
Tanganyika ¶	42
Portuguese Guinea	41
Egypt	
Upper Egypt	
Sharqiya	24
Others	3
Middle Egypt	1
Anglo-Egyptian Sudan	26
Union of South Africa	
Transvaal	12
Natal	4
Rhodesia (Southern)	5
Sierra Leone	5
Mozambique	4
Kenya ¶	3
Angola	1
Oceania:	
Australia	
Queensland	2

* Compiled from 1928–1929 International Yearbook of Agricultural Statistics, and Official publication of the various countries for the distribution of production by minor political subdivisions.

† Based on a study by the United States Tariff Commission, Report of January, 1929; also on American Consular reports.

‡ Shelled peanuts converted to unshelled; 1 pound shelled equivalent to 1.5 pounds unshelled.

¶ Exports.

1924 to 1925, we had a net export for the first and only time.

Peanut imports have fluctuated widely from year to year. Imports were high in 1917 with high prices in spite of the largest United States crop on record. Production was also high in 1918 and imports were small, but rose to a record height the next year, 1919 to 1920, along with peanut oil imports as a result of the drop in the United States crop. Net imports fell from 113,617,000 pounds in the fiscal year 1919 to 1920 to a net export of 3,351,000 pounds two years later. The drop was precipitated by the big increase in duty under the emergency tariff act of May, 1921. Imports increased 1922 to 1924 with smaller United States crops and higher prices especially for Spanish peanuts, and then dropped in 1925 with lower prices, but recovered somewhat in 1926 and 1927 and then fell off during the last fiscal year with the increase in duty on February 18, 1929.

Our peanut imports at first came principally from Africa, then from Europe (some of which originated in Africa) and since the beginning of the World War have come from Eastern Asia and are of the Virginia type. During and soon after the World War, Japan supplied most of our imports, a large part of which originated in China, but since 1924, China has supplied about 94 per cent of our total imports by direct shipment.

Domestic exports have been recorded since July, 1905, and amounted to about a quarter of a million pounds per year until 1916, about 1½ million pounds from 1916 to 1919, and then were unusually high in 1920 and 1921 when 13,000,000 pounds were exported in each of these two years. Our exports have been principally to Canada and some to the West Indies. Of late years, Canada has secured more of her peanuts direct from China and our exports have averaged but about 5,000,000 per year since 1922.

THE GULF PORT CITY REGION OF TEXAS

William T. Chambers
Geographer, Stephen F. Austin State Teachers College

ALL the important seaports of Texas are in that part of the bar and bay fringed coastal prairies between Corpus Christi and the Louisiana boundary. This area includes only a part of the coastal prairies of Texas, but it possesses marked geographic unity because the port business and associated industries constitute the chief basis of economic growth and prosperity, and the variety in landscape and in land utilization is essentially similar throughout. The region is an extensive, almost flat, grassy plain; notched by broad, shallow bays; and interrupted by many sluggish rivers, bayous, and creeks which are bordered in places by groves of oak, pine, cypress, and willow. Several thriving cities, including Houston, Galveston, Beaumont, Port Arthur, Orange, and Corpus Christi, are outstanding features in the cultural landscape. These centers are located on deep, sea-level ship-channels excavated in the shallow bays and along the courses of sluggish streams in the low-lying coastal prairies. They owe their prosperity and great regional importance to the performance of port services for an extensive and highly productive hinterland—services their accessibility from both sea and land enables them to perform. Line and tramp steamships thread their way through the deep, long ship-channels to load and discharge cargo at these cities. The ports are served from the land side by a variety of transportation agencies including railroads, highways, and petroleum and gas pipe-lines. Manufacturing industries and wholesale trades have grown in the larger centers as complements to the port business. The exploitation of enormous petroleum and sulphur resources has contributed to the prosperity of the region; and agricultural industries, especially rice growing and cattle raising, are important in rural districts.

Port activities are the chief basis of economic life in the cities. The leading centers are seaports, and their commercial and manufacturing industries are fostered by port business. The small cities base their hope for growth upon the acquisition of deep water and participation in the growing port business of the region. About 70 per cent of the population resides in port cities, and part of the suburban and rural population gains a livelihood by employment in these centers and by the production of vegetables, fruits, eggs, and dairy products for sale in the urban markets.

Every port in the region is largely a cultural phenomenon. Galveston, located on Galveston Island near the entrance to Galveston Bay, was accessible under natural conditions to ships drawing 10 to 12 feet of water; but dredging and the construction of jetties were necessary to obtain the present depth of 30 to 35 feet. Moreover, location on a low island off a marshy coast exposed the city to occasional ravage by sea-waves, and retarded access to and from the main-

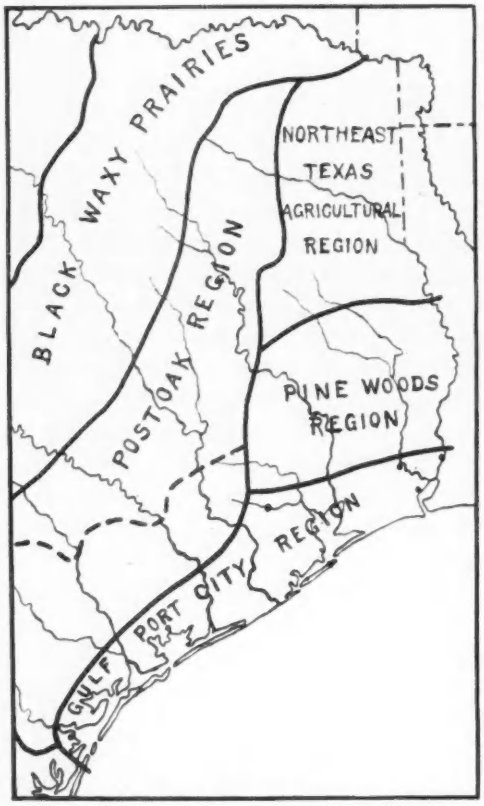

FIGURE 1.—The Gulf Port City Region of Texas and neighboring areas.

land. A great sea-wall was built, and the site of the city raised by filling in to give protection from the ocean; and a long causeway was constructed to provide communication with the mainland by railroad and highway. Houston was accessible to small vessels by way of Galveston Bay, San Jacinto River, and Buffalo Bayou; but completion of the Houston Ship Channel in 1914 marked the advent of the modern port. This sea-level channel is 50 miles long, 28 feet deep, and 150 feet wide. At Houston it has been widened to form a turning basin. The Sabine Port District in the northeastern part of the region is penetrated by a deep, sea-level channel dredged through Sabine Pass and Sabine Lake with branches along the Neches River to Beaumont and the Sabine River to Orange. Corpus Christi, in the southwestern extremity of the region, became a seaport with the opening (Sept. 14, 1926) of a ship-channel through Aransas Pass and Corpus Christi Bay to the city. Port Arthur, Texas City, Freeport, and Sabine are also located on deep, sea-level channels; and several other cities and towns anticipate the acquisition of deep water and participation in the growing port business of the region.

FOREIGN AND COASTWISE TRAFFIC

The foreign and coastwise trades of the Gulf Port City Region of Texas have already attained enormous proportions. They amounted to 31,819,624 tons, valued at $1,919,002,237, in 1925; and the movement increased approximately 2,000,000 tons the following year. The waterborne commerce of the region is

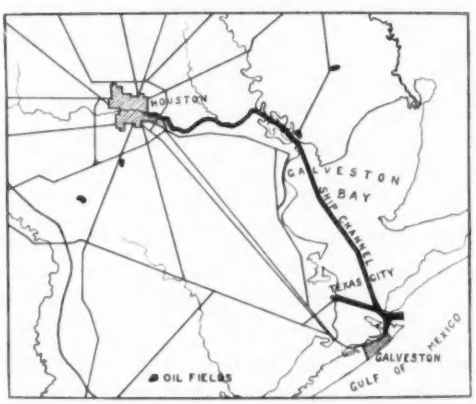

FIGURE 2.—The Galveston-Houston Port District showing railroad lines, ship channels, and oil fields.

materially larger, both in tonnage and value than that of Philadelphia, San Francisco, Los Angeles, Baltimore, or any other port of the United States except New York; and the tonnage is much greater than that of either the foreign or the coastwise

FIGURE 3.—Air view of Galveston showing part of the famous sea-wall which fronts upon the Gulf of Mexico and is 7½ miles long. (Courtesy of Galveston Chamber of Commerce.)

trade of that metropolis. Coastwise shipments and exports of gasoline, kerosene, lubricating oil, petroleum, cotton, cotton-seed products, crude sulphur, copper, lumber, wheat, flour, and rice constitute the great bulk of the trade; but the large port cities, especially Galveston and Houston, receive large quantities of iron and steel goods, petroleum, raw sugar, canned goods, automobiles, machinery, bags and bagging, bananas, coffee, fertilizer, and other commodities.

PETROLEUM AND PETROLEUM PRODUCTS

More than two-thirds of this enormous tonnage (22,418,301 tons in 1925) consists of coastwise and export shipments of petroleum products and petroleum. This trade is moved by tank steamships, and involves the transportation of millions of barrels of gasoline, kerosene, lubricating oil, fuel oil, and asphalt from the wharves of refineries and the terminals of railroads and pipe-lines to ports in the Northeastern States and in Europe.

The enormous volume of the trade is due to the strategic location of the region with respect to petroleum-producing areas. The great gusher fields of the coastal prairies such as Spindle Top, Sour Lake, Batson, Saratoga, Humble, Goose Creek, and

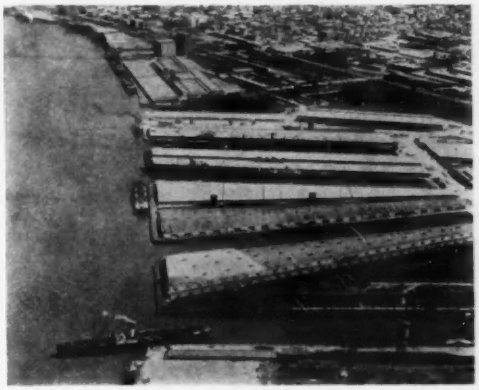

FIGURE 4.—Portion of the port at Galveston which has 32 piers with berthing space for 100 steamships. Galveston ships more cotton and sulphur than any other port in the world. (Courtesy of the Galveston Chamber of Commerce.)

Orange have produced abundantly for many years. Discoveries of producing fields during the first years of this century were followed by the construction of short pipe-lines to tide-water and the initial development of petroleum refining and shipping activities there. Subsequent

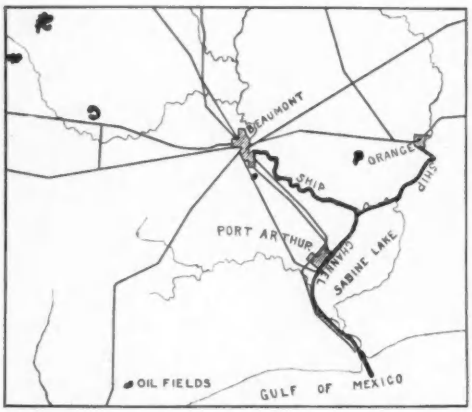

FIGURE 5.—The Sabine Port District showing railroad lines, ship channels, and oil fields.

development of fields in various parts of Texas and adjoining states resulted in the extension of pipe-lines and the building of new ones to connect centers of production with refineries at tide-water and tank steamer lines. Consequently, pipe-lines, ranging from six to twelve inches in diameter, converge upon this port region; and pumping stations keep petroleum pulsating through them from all the great centers of production in Texas and Oklahoma and from points in Louisiana, Arkansas, Kansas, Wyoming, and Montana to refineries and docks on the Texas coast. There is also a large movement of petroleum and petroleum products to the coast by railroad in tank car consignments. Since Oklahoma and Texas produce almost half of the petroleum output of the United States and about a third of the total for the world, it is patent that the hinterland of this port region has a large surplus for sale. The movement to world markets through ports on the Texas coast accounts for the vast proportions of the trade and the refining industry there.

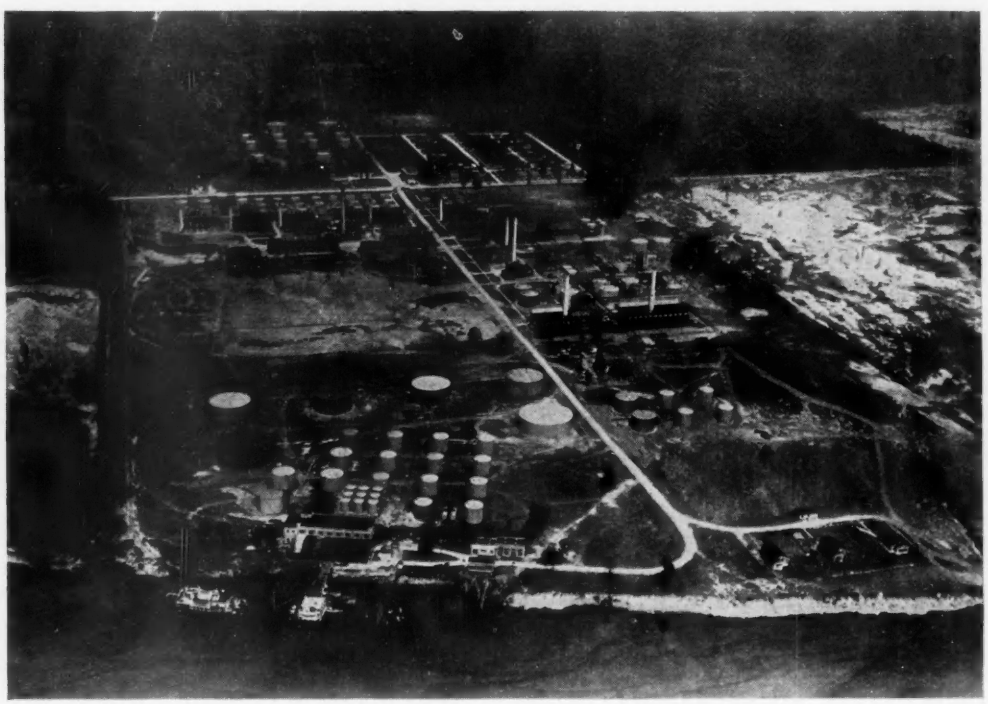

FIGURE 6.—Plant of the Galena-Signal Oil Company beside the Houston Ship Channel. (Courtesy of Houston Chamber of Commerce.)

Facilities for refining and shipping petroleum and its products have been expanded with the increase in volume of production in the territory served, so that the Gulf Port City Region has attained leadership in these activities. Thousands of acres of land adjacent to ship-channels at Port Arthur, Beaumont, Houston, and Texas City are used as storage-tank farms, as sites for petroleum refineries and by-product plants, and for wharf and terminal facilities by petroleum companies; and there are also large auxiliary factories which make and repair machinery, pipe equipment, and packages used in the industry.

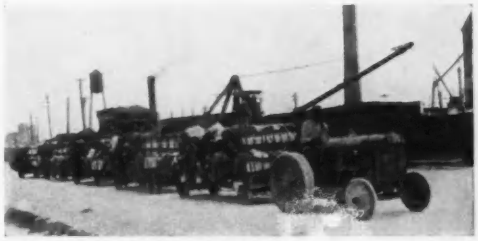

FIGURE 8.—Transporting cotton from warehouse to wharf at Galveston.

Some of the refineries have berthing space for four or five ships at a time; and maintain millions of barrels of oil in storage, connected with wharves by pipe-lines and powerful pumps, so that vessels carrying 75,000 to 125,000 barrels of oil can be loaded in 10 to 12 hours. Frequent and efficient services to market are maintained by tanker lines, which operate ships especially designed and built for the transportation of petroleum and its products.

FIGURE 7.—Manchester Terminal, the largest cotton compress in Texas. Note the Houston Ship Channel and the steamships at the wharf. (Courtesy of Houston Chamber of Commerce.)

COTTON AND COTTON-SEED PRODUCTS

Cotton ranks first in point of value among commodities shipped from the Gulf Port City Region of Texas,

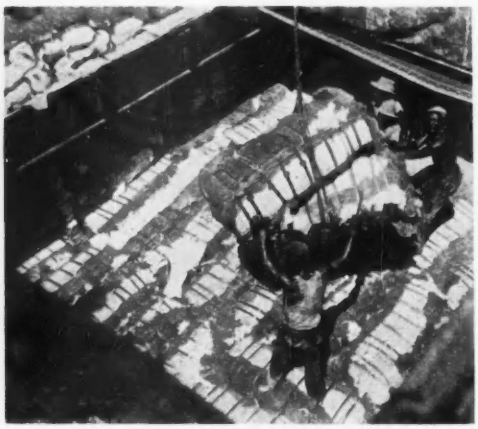

FIGURE 9.—Loading cotton aboard ship at Galveston. A process called "screwing" is used to press the bales close together, thus increasing the capacity of the carrier. (Courtesy of Galveston Chamber of Commerce.)

and there is also a large export trade in cotton-seed cake and meal. Foreign and coastwise shipments of staple were valued at $647,837,955 in 1925 as compared with $531,411,256 for petroleum and petroleum products; and the movement of cotton-seed cake and meal amounted to 249,270 tons valued at $10,916,095. Although the tonnage of cotton staple (1,316,764) was less than 6 per cent of that of petroleum goods, it was much larger than the cotton crop of Texas for that year and included almost a third of the entire output of the United States.

Practically all of this enormous trade in cotton and cotton-seed products moves through Galveston and Houston, which occupy first and second places, respectively, among the cotton-shipping ports of the world. Export and coastwise shipments of these commodities are made also at Corpus Christi, Port Arthur, and some other ports in the region. Each year millions of bales of cotton are produced in central, north central, and northeast Texas and in Oklahoma; and the great bulk of the crop moves into export and coastwise trade since the consumption of mills in these areas is still relatively small. The movement focuses upon Galveston and Houston because they are nearer most of the producing territory than competing ports, and have the additional advantages of more direct and frequent railroad service to various sections of the interior, of superior warehouse and storage facilities, of more frequent steamship services, and of much larger concentrating and shipping firms than other ports on the Texas coast.

The facilities for assembling and shipping cotton at these great ports are unexcelled. Railroads and highways radiate from Houston to producing areas in the interior, and excellent services are maintained to Galveston, although the island location of that city restricts the number of its contacts with the mainland. Railroads have good access to port facilities in each city, and there are

FIGURE 10.—Steamship (West Ouechee) at the dock of an elevator, Galveston.

several high density compresses which reduce the size of bales about 66 per cent in preparation for loading upon steamship. Each port has warehouse and storage facilities for approximately 1,500,000 bales, and is equipped with power machinery, including saddle-trucks and tractors, which move trains of especially con-

FIGURE 11.—Steamships loading flour and cotton at Galveston.

structed cars loaded with cotton bales from warehouse to shipside. Line and tramp steamers provide frequent sailings to cotton-consuming areas, including Great Britain, Germany, Japan, Italy, Belgium, France, and the northeastern part of the United States.

Shipments of cotton-seed cake and meal are consigned chiefly to countries in northwestern Europe, including the British Isles, Denmark, Holland, and Germany, where much of it is used as a feedstuff on dairy farms.

WHEAT AND FLOUR

Exports of wheat and flour from Texas ports (1,363,424 tons in 1926) have a tonnage about equal to that of cotton, but are far less valuable. The trade has expanded with improvements of port facilities, with adjustments of railroad rates to give equality in competition for the traffic with New Orleans, and with increasing production in northwest Texas and in parts of Oklahoma and Kansas until in 1926, it included almost one-sixth of the total overseas movement of wheat from the United States. Recent changes in the freight rate structure, giving Texas ports lower rates than New Orleans from points in Texas, Oklahoma, and Kansas which are nearer to them than to the Louisiana port, will doubtless stimulate further growth of the trade and the attainment of new high levels. The construction of large, modern elevators, car storage yards, and flour mills, which manufacture for the wholesale trade and for export, has accompanied the rise of the grain trade. Galveston secures the lion's share of the business, chiefly because it is located at tide-water relatively near to the producing territory, and has excellent railroad services from grain-shipping centers in the interior. Galveston also has the advantages of freight-rate equality with Houston from the wheat-producing areas; and of more frequent sailings to West European ports, greater elevator and car storage capacity, larger milling and shipping

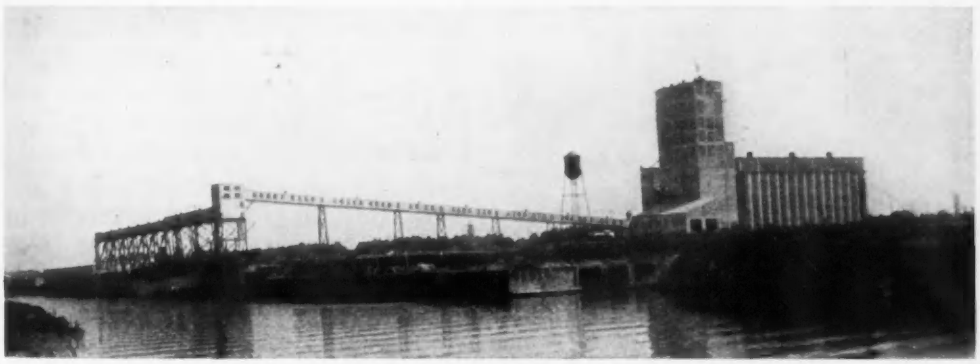

FIGURE 12.—Grain elevator located beside the Houston Ship Channel.

FIGURE 13.—Railroad cars loaded with sulphur at Texas City, Texas.

concerns, and greater depth of water in the port than competing centers as Houston, Port Arthur, and Texas City.

SULPHUR

Sulphur is moved in train loads from centers of production in the Gulf Port City Region of Texas and adjoining parts of Louisiana to wharves at Galveston, Sabine Pass, Freeport, and Texas City, whence it is shipped to the markets of the world. The total movement from ports in the region was 1,909,529 tons valued at $34,480,522 in 1925, and in 1926 it was 1,828,058 tons. There is an enormous production in the central part of the region at Freeport, Hoskins Mound, and Gulf in Brazoria and Matagorda counties; and part of the Louisiana output moves through ports in the Sabine District, especially Sabine Pass.

Essentially pure sulphur is obtained from deep under-ground deposits by the Frasch process. Water heated to 350° F. is pumped into the deposits through bore-holes. It enters the sulphur-bearing rocks near the base of the deposit, and melts quantities of the mineral. Part of the water is then shut off; and air pressure, exerted through a small pipeline, forces the sulphur to the surface, where it is discharged into basins to cool and solidify. The plank sides of the storage basins are then removed, and the mass of sulphur is drilled, blasted, and loaded into railroad cars for transportation to shipside.

Sulphur is used in a great variety of manufacturing industries, but practically all of the output is shipped from the region in the crude form. Enormous quantities are employed in the manufacture of sulphuric acid, gunpowder, and matches, and in making fertilizers, dip, and insecticides. Since these products are more bulky and difficult to ship than crude sulphur, there is probably little incentive to their large scale manufacture near the centers of sulphur production; but some development of manufacturing for markets in the South and in Latin America may occur.

FOREST PRODUCTS

Shipments of lumber, timber, poles, posts, staves, naval stores, and wrapping paper, having a total volume of about 500,000 tons annually, are made through the ports of the region. These commodities, or the materials from which they are made, originate in the forest belt of East Texas, and move chiefly through ports in Sabine District because of their proximity to centers of production. They are manufactured in the forest belt or at sawmills, creosoting plants, and paper mills located at Orange, Beaumont, and other port cities. The largest export and coastwise movement is through Beaumont, which has more than 40 per cent of the total, but Orange, Port Arthur, Galveston, and Houston also share in the trade. The volume of the traffic is declining with the exhaustion of the virgin

FIGURE 14.—Steamship (City of Philadelphia) loading mohair at Houston.

pine forests of East Texas and adjoining parts of Louisiana, but increasing utilization of the hardwood resource and reforestation of areas unsuited to agriculture promise to give it permanency.

MINOR COMMODITIES IN THE OUTBOUND TRADE

Other commodities moved in rather large quantity through ports in the region are copper, rice, mohair, wool, and lard substitute. The copper comes by railroad from smelters in Arizona, New Mexico, and western Texas to Galveston and Houston. It is shipped by ocean steamer to markets in the Northeastern States to avoid relatively costly overland transportation. Part of the rice crop of the coastal prairies moves by water to coastwise and foreign markets. Galveston and Houston also have important trades in wool and mohair from the sheep- and goat-ranching territory in Edwards Plateau and in lard substitute made from cotton-seed oil.

IN-BOUND TRAFFIC

Water-borne receipts of ports in the region are much smaller than the shipments both in tonnage and value, but there is a large and varied in-bound traffic at Galveston and Houston. In 1926 the receipts of ports in the region amounted to 3,689,242 tons, valued at $276,654,273. More than 43 per cent of this traffic on the basis of tonnage and almost 60 per cent of it on the basis of value moved through the Port of Galveston. Approximately a quarter of the total (955,060 tons valued at $65,568,521) both in tonnage and in value was credited to Houston; and almost all of the remainder was divided among Port Arthur, Texas City, Beaumont, Orange, and Corpus Christi. The supremacy of Galveston among ports of the region in in-bound trade is due to several factors. She has the advantages of location on the Gulf shore, and of a deeper and more commodious port than competing centers. Galveston also has more frequent steamship services than the other ports, and obtained a relatively early start in oversea commerce.

Leading commodities in the in-bound trade of the region are iron and steel goods, crude oil, canned vegetables and fruits, sugar, automobiles and machinery, paper, bags and bagging, coffee and tea, creosote, fertilizer, and bananas.

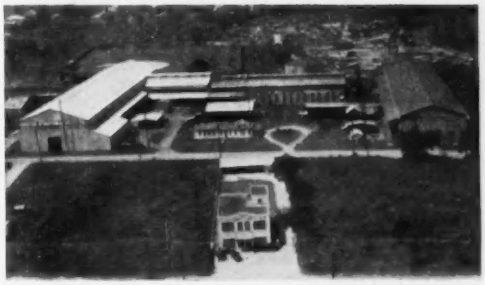

FIGURE 15.—Plant of the Houston Structural Steel Company, one of those industries which imports and processes goods for distribution to market in the Southwest. (Courtesy of Houston Chamber of Commerce.)

Practically all of this large and varied traffic is due to the economic insufficiency of Texas and adjoining areas to the north and west, and the

movement of goods produced elsewhere into this consuming territory. There is no great iron-smelting and steel-making industry in this part of the United States; and the cost of overland shipment from Birmingham or the Chicago District is so great that large quantities of hardware, railroad rails, wire manufactures, structural steel, pipe and fittings, steel plates, and steel bars are brought by water from producing areas near tide-water in the United States and Europe. In like manner, machines, newsprint, and bananas are brought by ocean carrier from producing districts to this market territory. Several commodities which bulk large in the trade are processed in the port cities before being distributed to market. Thus, steel pipes, plates, and bars are used in the manufacture of oil-field supplies at Houston, Beaumont, and Port Arthur; raw sugar is refined at Sugarland and Texas City; coffee is roasted and packed at Houston and Galveston; creosote is used in creosoting poles and timber at Orange; and fertilizing materials are assembled and mixed at Houston, Orange, and other centers. The large waterborne receipts of crude oil, notwithstanding the enormous production in the region and receipts from the interior, are due to the location of many large refineries in the region. These plants assemble special grades of petroleum from producing fields in California, Mexico, and South America for use in blending with the regional output in the manufacture of high grades of lubricating oil for various sorts of machinery.

AGRICULTURAL INDUSTRIES

Although only a small part of the land is cultivated, the rural environs of the Gulf port cities of Texas, together with an adjacent district in southwestern Louisiana, produce more than half of the rice crop of the United States and a variety of fruit and vegetable crops. There is also a large production of beef cattle, and dairying and poultry farming are developing in the vicinity of the larger cities.

FIGURE 16.—Rice field in early spring, before the plants were large enough to admit of flood-irrigation, showing the winding contour levees.

RICE PRODUCTION

Much of the land is admirably suited to rice production. The crop has ample time to attain maturity during the long, frostless growing season. In the eastern and central parts of the region, where most of the crop is grown, the rainfall averages 40 to 50 inches annually; and more than half of it falls during the spring and summer, when the rice plants need much moisture. Additional water for use in irrigation is pumped from the Colorado, Trinity, Brazos, Neches, San Jacinto, and Sabine rivers. Creeks, bayous, and artesian wells also supply water in some localities. The low-lying, almost flat land of the region facilitates the acquisition of water from streams, its distribution to farms by means of canals, and the flooding of rice fields to desired depths. Low earth embankments called *levees* are built along

contour levels at elevation intervals of five to six inches to maintain an approximately uniform distribution of water upon the fields. Drainage facilities are also installed; and machines, including tractors, gang-plows, seed-drills, and harvesters, are employed in the work. Tracts of tight, black clay and loam with heavy subsoils are used in the industry, for they conserve the irrigation water, contain an abundance of plant foods, and provide relatively firm root anchorage when the fields are flooded with water.

Several factors have tended to constrict the industry during recent years. The limited capacity of the American market for rice, the lack of tariff protection, the competition of other producing areas in the United States, the presence of brackish water in the lower courses of rivers and bayous during drought periods, the scarcity and high price of farm labor due to the rapid growth of the port cities, and the declining fertility of land used in the industry, have conspired to discourage production. The American People, except in rice-producing areas, are unaccustomed to use the grain as a staple food. The average housewife can prepare such a limited number of attractive rice dishes that rice-growers' associations find it difficult to increase consumption by advertising. Proximity to the rice-eating populations of the West Indies favors movement of the grain to market in Cuba, Porto Rico, and neighboring islands; but the relatively soft character of the grain as compared with that produced in the Orient restricts its sale there. The European market has rather small capacity for rice, and low-price levels and great distance conspire to prevent shipment of the

FIGURE 17.—A fig orchard in the Gulf Port City Region of Texas.

grain to Oriental markets. Competition in marketing with producing areas in Louisiana, California, and Arkansas also hampers the industry. Hence, production in the coastal prairies of Texas has been constricted by the threat of flooded markets and price levels below the cost of production so that both the acreage and output are smaller than they were prior to the World War, although large areas of untilled land are suitable to rice growing.

TABLE 1

DECLINE OF THE RICE INDUSTRY IN TEXAS

Year	*Acreage*	*Bushels Produced*	*Value of Crop*
1927	161,000	6,279,000	$5,400,000
1925	168,000	6,048,000	9,012,000
1920	281,000	9,554,000	11,942,000
1915	260,000	7,930,000	7,058,000
1910	264,000	8,738,000	5,942,000

After the grain is threshed, it is assembled in the larger cities of the region as Beaumont, Houston, Galveston, and Orange. Mills located in these centers clean and polish the grain, and pack it for distribution to market by railroad and ocean steamship.

VEGETABLE AND FRUIT CROPS

Interest in vegetable and fruit production has been increasing in recent years. The chief markets served are in the cities and towns of the region, but some shipments are made to distant centers. Mild, moist weather in the winter and early spring and

FIGURE 18.—Typical grazing landscape on the almost flat prairies of the Gulf Port City Region of Texas.

an abundance of sandy loam soil facilitate the production of vegetables at times when they command high prices. Car-load shipments are made to distant centers, but most of the output is marketed in the region. Extensive plantings of Magnolia figs have been made. They yield best on heavy loam soils where the ravages of nematodes are slight.

FIGURE 19.—Herd of pure bred Brahmas. Yearlings from this herd of cattle have been sold to ranchmen for as much as $1,300 a head.

Factories located in Beaumont, Houston, Orange, and other centers preserve and can the entire commercial crop, and distribute it to market. The industry is still young, but it has grown rapidly and will probably continue to expand as its products become familiar among American housewives. Satsuma orange groves are cultivated on a small scale throughout the region, and there are plantings of the Louisiana sweet orange, the Myers lemon, and grapefruit. Production of these citrus fruits is imperiled by occasional periods of freezing winter weather similar to that of January, 1928, when temperatures as low as 17° F. were recorded. It is estimated that 50 per cent to 75 per cent of the trees were killed back and many of them were killed. Home orchards suffered most for they received little or no protection from the cold, but large plantings, which were protected by smudge pots, escaped with relatively small loss. After more than 15 years of experimental production, it seems probable that growers who go into the business on a sufficiently large scale to justify the use of smudge pots during the coldest weather and of spraying equipment can succeed in producing frost-resistant varieties of citrus fruit.

CATTLE RAISING

The Gulf Port City Region is one of the important cattle-raising sec-

tions of Texas. Extensive tracts of almost flat, prairie grass-land are divided into fenced ranches and devoted to the production of beef cattle, which are more than eight times as numerous as milch cows. The coarse, prairie grasses grow luxuriantly, but have rather low nutritive value. Large areas along the coast, especially in the more humid eastern part of the region, are poorly drained and infested by fever ticks, mosquitoes, and flies so that they are stocked below capacity, and the cattle do not keep the grass eaten down. Brahma cattle, introduced from India, have been crossed with native stock to produce animals well suited to life in the region. The nervous temperament of the Brahma, the relatively coarse quality of its meat, and its large development of rather cheap neck and shoulder cuts have handicapped the movement. Yet, most herds have some admixture of the Brahma, because its ability to survive on the hot, marshy, parasite-infested range, and to thrive and grow on the coarse prairie grasses is much greater than that of standard breeds. There is a meat-packing plant at Houston, but most of the cattle are shipped to Fort Worth and Kansas City for slaughter.

Dairying is becoming important in the environs of the larger cities as Houston, Galveston, Beaumont, Port Arthur, and Corpus Christi. Milk and cream are produced for sale in these urban markets. The cows graze on prairie pastures, but practically all their feed, including corn, grain sorghum, and cotton-seed meal are shipped into the region.

FIGURE 20.—Looking northeastward across the central business district of Houston. The Sam Houston Auditorium, erected for the Democratic National Convention of 1928, is in the central foreground. (Courtesy of Houston Chamber of Commerce.)

THE REGIONAL METROPOLIS

Houston, the master port city of Texas, has established her urban ascendancy in the Port City Region and a large contiguous territory.

FIGURE 21.—Another one of the factories located beside the Houston Ship Channel. (Courtesy of Houston Chamber of Commerce.)

The population increased from 78,800 to 138,276 between 1910 and 1920, and is now said to be approximately 250,000. The urban vortex has an imposing skyline of office buildings, business houses, and hotels. Already much larger than any other center in southeastern Texas, Houston has more opportunity for further growth than urban competitors in that territory. Location on a sea-level ship-channel fifty miles inland from the coast at a great concave bend in the shore line makes Houston the nearest port to the enormously productive Black Waxy Prairies of north central Texas and several adjoining areas. Many of the major railroads, highways, and pipe-lines which serve this territory converge upon Houston, making it the outstanding focus of land transportation facilities in a large section. It is also the westernmost Gulf port terminal of southern transcontinental railroads and highways, and has more frequent steamship services and better port facilities than any competitor except Galveston. These factors, together with the rapid economic development of the Southwest, foster the rise of port business, manufacturing industries, and wholesale and retail trade; and impart convincing quality to the belief of the population that Houston will become the metropolis of Texas and a large adjoining territory.

FUTURE OF THE REGION

Continued growth of the port cities of Texas and development of resources in their rural environs seem assured. Export and import trade will increase as the economic development of the hinterland progresses. Relatively low ocean rates from coastwise and foreign centers, together with rail rates based on those by water, facilitate the expansion of wholesale business, the assembling of materials for manufacture, and the distribution of goods to market throughout the hinterland and in foreign countries. Relatively cheap power produced by the use of fuel oil, natural gas moved to the region by pipe-lines, and an abundance of raw materials including cotton, petroleum, sulphur, wheat, and wood also foster continued growth of manufacturing. Lignite deposits, located a short distance inland, constitute an enormous reserve of fuel and raw material that will probably be used extensively in the future. Large tracts of ranch land may be drained and used to grow vegetables and figs, and the rice acreage will probably expand as the capacity of accessible markets increases. The dairying industry will grow with the urban population of the region, and the production of oysters and fish can be increased. Mild, pleasant winter and summer weather, as compared with that of areas in the continental interior, together with sea shore sports, promise continued growth of the tourist and resort business, which is already important at Galveston. The vision, enterprise, and energy

FIGURE 22.—View of the beach at Galveston, the "Playground of the South." (Courtesy of Galveston Chamber of Commerce.)

of the population have been stirred by growth and achievement to plan and work for great objectives; and conspire with variety and great magnitude of opportunity to indicate sustained growth of the port cities, and increasing intensity in utilization of the agricultural, mineral, and marine resources of the region.

CHICORY: MICHIGAN'S INFANT MONOPOLY CROP

Floyd A. Stilgenbauer
Geographer, College of the City of Detroit

MICHIGAN produces nearly all of the commercial chicory grown in the United States. Prior to the tariff readjustments of 1897, about 8,000 tons of raw or finished chicory were imported annually from Europe. After the tariff schedules of the 55th Congress went into effect, importing companies investigated the possibilities of raising the crop in the United States on the basis of physical environment, and found the Wolverine state best suited for culture. Dryers and finishing plants flourished under the protective tariff for infant industries, until today, Michigan has a monopoly on chicory culture producing fully 95 per cent of the American crop. Production is dependent on the demand for chicory by coffee roasters, manufacturers of cereal coffee substitute, and wholesale grocers, who purchase the major portion of the manufactured product. Cultivation and manufacturing are regulated by the home market conditions, the tariff, and the extent of foreign importations.

Origin of Chicory Production in the United States

Chicory, a perennial plant resembling a parsnip, has been produced in the Saginaw Valley and Upper Thumb Counties of Michigan for about three decades. A very minor production has subsequently developed in California, Illinois, Wisconsin, and Nebraska. All chicory consumed in the United States prior to cultivation in Michigan was imported from Belgium, France, Germany, and Holland. This herb was carried to Western Europe by the Romans. In the writings of Horace, the Roman poet, there are references to chicory, indicating that this plant was grown in the Roman Empire and has been consumed by man as a food for nearly 2,000 years. Chicory was grown at least 1,000 years before the coffee plant was discovered in the Highland of Abyssinia. Chicory was improved in Western Europe by careful selection of seed stock and finally introduced into the United States by Europeans interested in the manufacture of a granulated product for beverage purposes.

Tariff regulations incorporated in the McKinley Bill of 1890 provided for a tax of 2 cents per pound on burned, roasted, ground, or granulated chicory imported into the United States, but the dry root remained on the free list. Americans of European birth demanded finished chicory, or coffee containing chicory, and there were no factories in this country for its manufacture. In 1880, a total of 14,547,700 pounds were imported from Europe. Foreign interests encouraged by the tariff regulations established small factories in the market centers of the United States, and thereby avoided the import tax on the product to be sold in America. By readjusting the tariff schedule, the United States Government encouraged the development of chicory manufacturing in

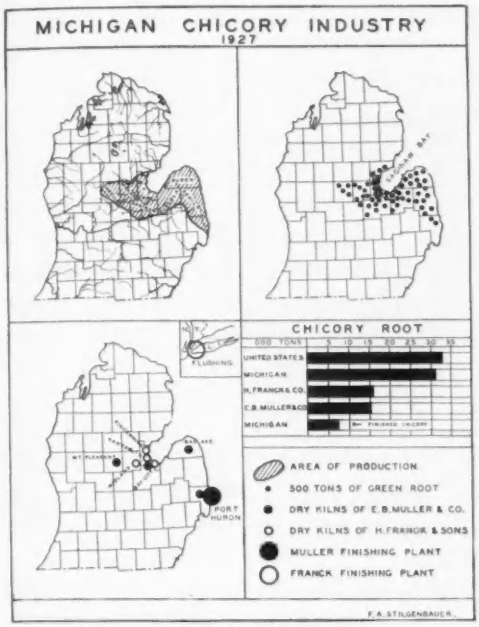

FIGURE 1.—Chicory distribution in Michigan in relation to dry kilns and finishing plants. The Saginaw Valley and Upper Thumb Counties produce 95 per cent of the chicory grown in the United States.

this country. These small finishing plants were operated for the most part by Belgians in New York and other large market centers, by importing most of the dry root from Europe where culture was firmly established. Under this arrangement the chicory business remained in the hands of foreigners and the tariff regulation only served to foster a shift in the position of the finishing plants to the market centers. Little competitive domestic culture developed for the foreign companies, in view of the fact that one ton of the dry root can be shipped at a cost comparable to that of the finished product in bulk, since there is little change in volume or weight during the finishing process.

In 1897, the tariff bill was altered by the United States Government to encourage home production of the root. Congress levied a tax of 1 cent per pound on the raw or dry root in order to aid the American farmer in the production of this new crop. The duty on finished chicory was increased to 2½ cents per pound. Under the new tariff schedule on raw and refined chicory, the small manufacturing plants in America suffered a marked business depression. The result was three-fold; first, the importation of dry and prepared chicory declined from 17,329,170 pounds in 1897 to 494,616 pounds in 1899; secondly, culture was established in the Saginaw Valley where natural conditions were ideal for the plant, and where the sugar beet industry was beginning to thrive; and thirdly, the small manufacturing interests were stimulated to consolidate or develop into large-scale finishing plants so located as to receive dry root conveniently from evaporating kilns within the local producing region, or from foreign fields if market conditions demanded, and to supply the consumer with the finished product at low cost. By 1899 the United States produced 21,495,870 pounds of which 19,876,970 pounds were from the Wolverine State. Michigan has a monopoly on chicory culture, and besides, E. B. Muller and Company of Port Huron, Michigan, manufactures nearly half of the domestic finished product (Fig. 1). The remainder is prepared by H. Franck and Sons of Flushing, N. Y., representing a consolidation of the Michigan, National, and United States Chicory Companies.

USES OF CHICORY

In the beginning chicory was used in Europe as a food, and, to a small extent, for medicinal purposes because of the mild laxative and tonic effects of its milky juice. The food

value of the plant was first confined to its use as a vegetable. In Belgium the fresh roots are boiled and served much the same as carrots and parsnips in America. Witloof, a head-like variety of chicory top, provides material for salads during the winter. For Witloof, the roots are ensiled in earth under the bench of a greenhouse, covered with tanbark or such like materials on which manure has been placed. The head-like leaves are cropped until the product becomes excessively bitter. In parts of Europe the leaves are used to a limited extent in the manufacture of blue dye. Also, the plant is sown broadcast on infertile steep slopes for pasturage. In France the roots are placed in earth in a warm dark cellar with about one inch of the top remaining, and in three or four weeks the fine white leaves are cropped at intervals to be used for a salad known as *Barbe de Capucin*. In the United States this salad is considered a delicacy particularly by people of foreign ancestry, and is sold under the name of *Endive*. As a pot-herb the young leaves are cut when six to eight inches long, boiled in two waters to remove the bitter flavor, and served like spinach. Because of the bitter flavor, chicory has never become widely popular in America as a vegetable.

In modern times chicory has been used most extensively as a beverage, and a blending material for coffee. It was first adopted as a beverage by the Hollanders at the beginning of the Nineteenth century. The root was cut into small pieces, laid in the sun to eliminate the moisture content; then, after roasting and grinding, a brew was prepared from the product, and consumed in much the same manner as we use coffee. When coffee was scarce, inferior in quality, and high in price during the blockade of the Napoleonic Wars, the Hollanders substituted chicory. Later, by adding varying amounts of chicory to coffee at a time when improved methods of making and keeping the brew were unknown, it was discovered that in standing brew the combination was superior to either as a pure beverage. Holland, by the process of blending Java coffee and chicory, assumed a noteworthy position in the world market, and is still a large consumer and exporter of blended coffee.

Holland blends of coffee met with great favor in the hotels, restaurants, and cafes of the United States because of their ability to hold the flavor and aroma in standing brew. American roasters followed the practice of the Dutch in preparing brands of coffee blended with chicory for the hotel and restaurant trade. Today, the United States is the leading coffee market taking 47 per cent of the total world import (1923–1925 average) and consuming an average of 1,344,000,000 pounds annually. France, Germany, Holland, Belgium, Sweden, and Italy are ranking consumers, and together with the United States and tropical countries provide leading market centers for chicory.

VALUE WHEN ADDED TO COFFEE

Chicory added to coffee causes the brew to retain its characteristic and desirable flavor and aroma by holding the caffeol for a longer period of time. Just how this action takes place has not been definitely proved. The experiments conducted at the University of Michigan [1] give evidence that the caffeol of coffee is held in the

[1] Smith, C. N., and Bartell, F. E., Department of Engineering Research, Report of Effect of Chicory on the Properties of Coffee. 1924, Ann Arbor, Michigan.

brew "by an action of some active constituent of the chicory extract," and, "through some type of chemical reaction with the apparently soluble constituents of chicory." By a distillation test it was shown that the presence of chicory appears to hold back in some manner a portion of the volatile oil which constitutes the aromatic portion of coffee, and which is the active constituent that accounts for the more lasting odor and flavor of the brew. Individual taste and aroma tests substantiate the experimental evidence in favor of the retentive action of chicory on the caffeol of the coffee brew.

Aroma and taste tests were conducted with five persons designated A, B, C, D, and E. Samples of pure coffee brew, coffee brew with 3 per cent chicory, and with 10 per cent chicory, were presented to each individual without any information as to positive identity of the liquids, so as to obtain an unbiased reaction in each case. The accompanying chart illustrates the result of these very careful individual tests (Fig. 2). All aroma tests are presented on the left and the taste tests on the right half of the chart. The first column of blocks vertically indicates each individual's choice for pure coffee brew; the second, for brew with 3 per cent chicory; and the third, brew with 10 per cent chicory. The horizontal column designates each individual's choice in the test. All dashed spaces show that no choice could be decided upon.

In the aroma test taken at the end of one hour, two of the five individuals preferred pure coffee, two expressed first choice of coffee with 3 per cent chicory, whereas one expressed first choice for the brew with 10 per cent chicory. At the end of eighteen hours, three of the five preferred the aroma of coffee with 10 per cent chicory and only one selected the pure sample. It was also discovered that this individual had a natural liking for weak coffee which explains his choice of selection. Similar but more pronounced results were obtained in the taste tests. Two persons selected pure coffee at the end of one hour, whereas three selected the sample containing 10 per cent chicory. At the end of eighteen hours, nobody gave pure coffee brew a first choice. Three selected coffee with 10 per cent chicory and two with 3 per cent chicory for first place. Short period (1 min. to 30 min.) choices were erratic, but as the brew stood for longer periods, there was a very marked tendency to select the sample containing varying amounts of chicory up to 10 per cent.

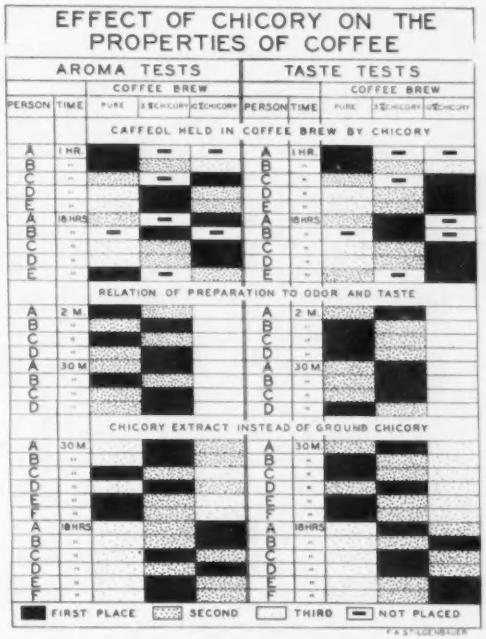

FIGURE 2.—Graphic representation of individual tests designed to show the effect of chicory on the properties of coffee brew. (After C. N. Smith and F. E. Bartell, Univ. of Michigan.)

Like results were obtained in tests

of preparation of the brew, and the use of chicory extract. The above experiments show that chicory has a retentive action on caffeol. Chicory is a blending material which helps coffee retain its flavor and aroma, and not an adulterant. This quality is especially desirable for coffee shops, restaurants, and hotels where the brew must stand in percolators during a three- or four-hour luncheon period. Coffee roasters use chicory to advantage for marketing coffee beans of varied quality by blending into a satisfactory palatable product, yielding a brew with a deep amber color. Free from alkaloids such as caffein, and acids such as tannin, which act directly on the heart and nervous system, chicory is a healthful food which tends to improve the coffee brew, aid digestion, and stimulate the liver. A weak brew of pure chicory is sometimes used as a beverage.

The use of chicory is governed somewhat by climatic conditions. Chicory is used with coffee most extensively in warmer climates where the higher temperatures increase the rate of evaporation of the caffeol, or flavoring oil of the brew. In the warmer southern climates, 20 per cent chicory and 80 per cent coffee compose the brew. In the cooler northern climates from 6 to 10 per cent of chicory is generally added. The high percentage of chicory has great retentive power on the caffeol which tends to offset the greater evaporation of the flavoring oil with the higher temperatures. The presence of chicory also tends to lessen the loss of caffeol in over-cooking the brew during preparation.

PHYSICAL REQUIREMENTS FOR CHICORY PRODUCTION

The physical requirements for profitable commercial chicory production are not unlike those for the sugar beet, but culture is more restricted. About 8,000 to 10,000 acres are annually grown in east central Michigan. This is scarcely one-seventy-fifth of the total area planted to sugar beets in the United States. Bay, Saginaw, Tuscola, Huron, Sanilac, Midland, and Isabella Counties comprise the major portion of the chicory region (Fig. 1). Chicory culture is more limited in areal distribution; first, because the plant yields best in the fertile valleys of a northern agricultural area; and secondly, because the utility of the finished product is not extensive. Hence, the land best suited to the cultivation of root crops is selected for chicory. The plant resembles the sugar beet in its outward appearance, but is a closer relative of common lettuce and the dandelion. Uninformed observers not infrequently mistake chicory for sugar beets in the Saginaw Valley.

A cool climate is essential to the production of a high-quality chicory root. Production is concentrated between the mean summer isotherms of 67° F. and 70° F. on lands where the annual rainfall ranges from 25 to 40 inches. At Bay City, Michigan, which is in the heart of the chicory area, the mean summer temperature is about 68.8° F. and the annual rainfall nearly 32 inches with a decided summer maximum. The plant is strongly drought and frost resistant, thereby minimizing the farmer's risk of crop failure with prolonged dry or cold spells. High resistance to cold and dryness during the growing season favors this plant for crop rotation purposes, since the farmer is reasonably sure of a good yield when other crops often fail. Growers consider chicory to be one of the most profitable cash crops of the Saginaw

Valley. Like the sugar beet, the plant is at its best during the cool days of the fall season, and the harvest comes after the frosts when most farm crops have been gathered.

Chicory culture requires a fertile, well-drained loam or clay loam soil for maximum yields. Any good corn, bean, or beet soil is suitable. The plant does well on dry soils, but lands too wet for small grains yield deformed and stunted roots, unless the water table can be lowered to normal depth by proper drainage (Fig. 3). In a well-drained soil with the water table from three to five feet in depth, the root grows long and straight in its effort to get a supply of water from the zone of saturation. Wet soils often result in delayed cultivation, deformed roots, and increased tare, with heavy losses to the farmer. New soils are poor for chicory since the root has a tendency on such lands to develop too much ligneous fiber which must be separated and discarded as a waste material. Muck soils, unless previously farmed and carefully handled, give like results. Soils should also be loose, medium to fine, and friable in texture for normal growth, otherwise careful tillage is essential to prevent deformities of the root stock. Chicory draws a moderate amount of nourishment from the soil, and some of the lighter farms produce at a profit when other crops do poorly.

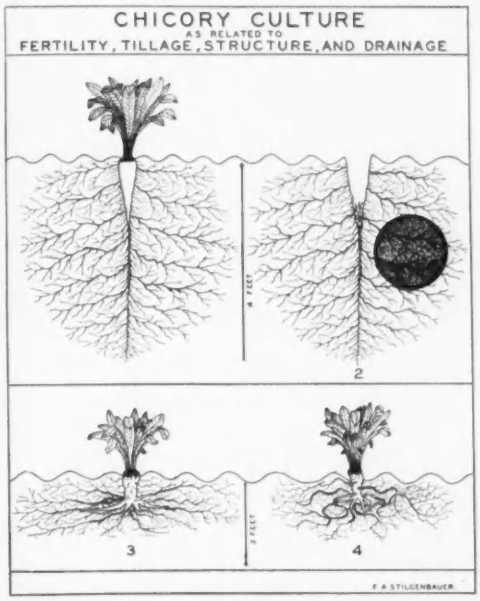

FIGURE 3.—The influence of land surface, soil, and drainage conditions on the development of the root stock, and vice versa. (1) A normal chicory plant grown under ideal physical conditions. (2) After the root is harvested the tributary feeding roots with thousands of hair-like appendages remain in the soil to improve the structure, fertility, and capillarity. (3) Shallow tillage prevents the downward extension of the root resulting in a deformity, which is costly to the grower in tare. (4) A deformity resulting from poor drainage when water is too plentiful near the surface. In this case, the root is not stimulated to extend downward in search of water. A lowering of the water table corrects this condition.

Chicory, like other root crops, has a marked tendency to improve the soil structure. The hair-like root system extends to a distance of four feet or more in depth. When the main root is removed, the tributary feeding roots remain in the soil. Decomposition of these minute roots not only leaves considerable nourishment which was obtained from the air, but also keeps the ground from becoming hard or cloddy, and provides capillaries for the free movement of ground water. Soil structure is generally satisfactory where chicory is included in the crop rotation.

The best chicory grows on a neutral soil with a high nutrient content, and these, fortunately, are within the control of man. If the soil is acid, plenty of lime or marl is added to insure proper root development. The Michigan Agricultural Experiment Station recommends the use of plenty of barnyard manure or a well-

FIGURE 4.—A one-hundred-acre field of healthy chicory produced in the Saginaw Valley for E. B. Muller and Company. Level land is plentiful in east central Michigan and a large acreage is devoted to root crops. Soils are rich and loose for the most part, but natural drainage is retarded by the flatness of the surface, so that tilling is a necessity for root farming. (Courtesy of E. B. Muller and Company.)

balanced commercial fertilizer to keep the soil in good tilth. Farmers use 150 to 200 pounds of acid phosphate per acre to insure a better balance of plant food and to render the manure more useful.

Land surface conditions have an important bearing on the development of the root stock. Chicory, like most vegetables, develops a root of better form and quality on comparatively level lands (Fig. 4). On the steep slopes, the soil frequently washes away from the plant, exposing a considerable portion of the root to the light, which tends to increase the ligneous fiber content. Hence, the usable portion of the root is decreased, resulting in a loss to the manufacturer. On level lands the grower is able to keep the root well covered with earth and get maximum utility from the root stock.

The grower selects chicory land in part according to the vegetational cover. Although a hardy vegetable under cultivation, chicory is not a strong competitor of native or cultivated grasses. Somewhat like wild lettuce, the plant thrives where the grass cover has been disturbed for some time previous to planting. Since domestication, the plant has been protected against competition with hardy grasses. Higher yields are obtained after a hoe crop. Chicory, grain (oats or barley), and hay (clover or alfalfa) generally followed by corn, potatoes, or beans is a common and profitable rotation. Where sod is used the land is plowed in the fall for spring planting.

INSECTS AND DISEASES

Natural selection of the most fit through centuries of cultivation in Europe produced a sturdy root stock. Seeds of the healthiest and most prolific plants were originally introduced into the Saginaw Valley, and, as a result, no serious diseases or insect pests have been prevalent. Then, too, the chicory plant has developed a distasteful bitter juice during its long existence, which is further protection from enemies. If the soil remains wet in the early part of the growing season, the young seedlings often suffer from damping-off, a fungus disease which kills the plant. Careful drainage corrects this difficulty. Cutworms and wire worms sometimes do slight injury to the crop if planted after old sod, but generally, insects avoid this bitter herb. The few pests and diseases are controlled by proper rotation, cultivation, and drainage. Chicory has much greater resistance to pests and diseases than the sugar beet, which

FIGURE 5.—Young chicory in the four-leaf stage immediately after the thinning operation has been completed. Only the strongest and most promising plants are left at intervals of 8 to 10 inches in the row.

is seriously damaged by several dangerous enemies.

METHODS OF CULTIVATION

A well-prepared seed bed contributes a great deal to the success of chicory culture. The weakness of the young seedling, the regularity of the stand, the need for extensive root expansion, and the scope of the feeding area are factors which demand a deep, fine-to-medium textured, well-firmed, and well-drained seed bed for correct root development. Fall plowing to a depth of 7 to 10 inches is the common practice. Shallow, haphazard cultivation results in ill-shaped roots. In a well-drained seed bed where deep cultivation and the liberal use of fitting machinery have been applied, the root assumes proper size, length, and shape since efforts to expand are not retarded in any direction and the lowering of the water table increases the feeding area of the plant. Ill-shaped roots tare heavily as all prongs are discarded. Besides, deformed roots hold a great deal of earth which is included in the tare subtracted from the gross weight of roots delivered. A carefully prepared seed bed minimizes the danger of accident, facilitates intensive cultivation, increases the probability of a perfect stand, and insures a maximum gross tonnage per acre.

Planting takes place between early May and early June, depending upon seasonal conditions. Generally, farmers plant about the middle of May. Considerable experience, skill, and judgment are necessary to determine the right time for planting. If sowing is done too early, many of the plants will produce seed stocks the first year. This is undesirable for such roots grow under normal size and contain a larger amount of ligneous fiber. Late planting shortens the growing season and roots do not reach full maturity before climatic conditions make harvest imperative. A sugar beet planter or a hand-pushed garden drill is used to sow the seeds continuously in rows about one-fourth of an inch in depth and from 18 to 28 inches apart. About two pounds of seed are required to plant an acre in order to insure a satisfactory final stand. A thick preliminary stand affords greater protection for the tender young plants, better opportunity to choose the strongest through survival of the fittest, and proper spacing of the final stand.

Chicory receives the same intensive cultivation that might be expected of any vegetable crop. Much care is given during the early part of the growing season. If the soil hardens soon after planting from alter-

FIGURE 6.—Hoeing time in a chicory field of Bay County. Laborers contract to keep the fields free of weeds during the growing season. (Courtesy of E. B. Muller and Company.)

nating rain and sunshine, the crop is rolled with a cultipacker to break the crust so the tender young seedlings can push through the surface. Cultivation begins as soon as the rows are visible and continues as needed throughout the growing season. Each successive cultivation is made less deep to avoid disturbing the lateral feeding roots. The rows are blocked with a hoe when the plants have reached the four-leaf stage so that small bunches of plants occur every 8 or 10 inches apart, which later are thinned, leaving only the strongest plants (Fig. 5). Thinning is the most important and costly operation performed during the growing season since yields may be greatly decreased by unskilled or unsupervised laborers carelessly removing the desirable plants. Delayed thinning disturbs the rapidly forming root system and retards growth. One or two hoeings are given to keep the field free of weeds, which draw seriously on the soil fertility as well as make undesirable shade for the chicory (Fig. 6).

CULTIVATION FOR SEED

All the chicory seed used in the Michigan region is imported from Belgium and Germany. At times of high prices, small quantities of seed have been produced in Michigan. It is not customary for the chicory manufacturers of the United States to grow their own seed and, therefore, little attention has been given to the development of special facilities to foster this phase of the industry.

In order to produce chicory seed, a two-year period is required. Lower labor costs, better storage facilities, and greater skill favor the production of seed in Europe. Perfect mature roots are selected from the seed crop of the first year, ensiled in dry sand in a cool dry place to prevent sprouting, replanted in rows during the spring of the second year, and cultivated as before. The food stored in the root is sufficient to produce a vigorous bush-like stem early in the growing season (Fig. 7). Many sky-blue blossoms appear on each plant about the middle of July, and the cool days of early autumn stimulate seed development. Each plant yields a small quantity of seed not unlike that of lettuce. Great care must be taken in harvesting and thrashing, so that the seeds are not lost, as chicory is a pestiferous weed

if allowed to escape from cultivation. Thrashing often consists of flailing out the seed by hand methods, but the larger producers thrash and clean the seed mechanically. After cleaning, the product is sacked in bags for shipment to America. The seed is furnished to the farmers by the chicory companies.

LABOR PROBLEMS

All chicory is grown under contract negotiated between the farmer and the chicory company where the entire raw product is marketed. From 1,800 to 2,100 farmers of eastern Michigan contract to grow chicory yearly. Nearly 4,000 farmers grow chicory at one time or another

FIGURE 7.—Chicory seed growing requires a two-year period. During the second year, the replanted root sends forth bush-like stems which produce numerous sky-blue blossoms that yield seed with the coming of cool weather in the autumn. (Courtesy of E. B. Muller and Company.)

depending upon rotation plans. The price per ton ($11 in 1928) is established at the time the contracts are negotiated. Growers can draw money on the contracted crop from the manufacturer in order to take

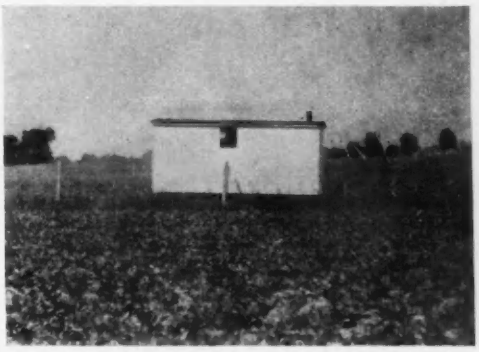

FIGURE 8.—Summer home of the laborer beside a field of chicory. A home on wheels can be moved from one field to another as the occasion demands.

care of labor and living costs during the season. The balance is paid the farmer when the roots are delivered at the weigh-station in the fall. Manufacturers often secure labor for the farmer, and in some cases pay rentals and operating costs. Attention to finance and labor details is quite necessary by the manufacturing concerns in order to interest farmers in the production of a crop which demands very intensive methods of cultivation. Growers are busy executing their portion of the agreement, which calls for preparation of the land, performance of machine cultivation, supervision of hand labor, lifting of the roots, and delivery at the weigh-station.

The hand-labor problem is not difficult to solve since the beet sugar interests bring hundreds of laborers to the neighboring fields where a parallel labor function exists. Here is an example of similar industries seeking the same locality because of common interest in geographic and economic problems. Mexicans, negroes, and industrial workers from the cities, who have obtained some knowledge of root culture in Europe or the United States, are much in evidence in the chicory fields. A

laborer with his family lives in a small tenant house, or a portable house constructed especially for the root industry, and performs other services about the farm when the root crop does not need his attention (Fig. 8). If the grower is short of help on his farm, he contracts with the chicory company to furnish foreign labor to do the hand work at $27 per acre. Thinning, blocking, hoeing, pulling, and topping constitute his share of the labor function. Women and capable children aid the male members of the family in these activities (Figs. 6 and 9). The earnings and living conditions of the chicory laborer are generally better than those of a similar class who remain in the industrial centers to face the seasonal unemployment period characteristic of the automotive manufacturing cities of Michigan.

FIGURE 9.—General view of harvesting operations in the Michigan Chicory Region. Roots are loosened in the earth with a double-shared plow, then pulled and topped by hand labor. Women and capable children aid the male members of the family during the chicory season. Piles of roots are ready for the market, or to be covered with tops to prevent loss in weight by evaporation until the grower is able to deliver them at the weigh-station. Children often cover the piles with tops and think it is great fun.

HARVEST AND YIELD

Harvest begins about the first of October and continues well into November. The coming of frost stimulates the plant to ripen, which is generally indicated by the lower leaves turning brown. Freezing temperatures do not injure the root, which can be harvested after the ground is slightly frozen. However, alternate freezing and thawing is injurious and lowers the quality of the finished product. The chicory root makes its greatest increase in size during the cool weather of autumn and harvest is delayed as long as possible to increase the tonnage without running too great a risk of serious damage.

Harvest operations are essentially the same as for sugar beets. Lifting, pulling, and topping are the major operations. Heavy rains interfere with the harvesting performance as the fields become muddy, earth clings to the roots increasing the tare, and the soil structure is impaired. A double-shared plow loosens the roots in the ground. Laborers pull up the roots, strike them together to knock off the earth, toss

into piles, and top with a heavy knife. If the farmer is unable to market them at once, the piles are covered with tops to lessen loss in weight from evaporation (Fig. 9). Unlike sugar beet topping, none of the crown is removed from the root. Such ligneous fiber is successfully eliminated at the finishing plants.

Chicory fields are generally small on account of the intensive nature of cultivation. An average field contains from 4 to 5 acres, and occasional fields 20 to 100 acres. The total yield in 1927 amounted to about 31,000 tons of green root from approximately 9,000 acres or an average yield of 3.45 tons per acre planted. Yields of 6 to 10 tons per acre are not uncommon on the better lands. A considerable acreage is generally unharvested because of the poor quality of the crop resulting from heavy rainfall, poor drainage, and late planting. Many growers have eliminated much of the cause for failure by practicing improved methods of culture.

Tops are fed to beef cattle or scattered on the field for their manurial value. Cattle are frequently turned on the field to pasture the tops after the roots have been removed. The feeding value of the tops is undoubtedly about the same as for the sugar beet. Chicory tops are not considered good food for dairy cattle since the bitter flavor of the juice has a tendency to taint the milk.

FIGURE 10.—In the fall great activity prevails at the weigh-stations where the roots are delivered from the fields for scaling and shipment to the dry kilns. The roots are dumped in huge piles for protection against frost damage while awaiting shipment. Weigh-stations occupy focal points along the railways of the Chicory Region. (Courtesy of E. B. Muller and Company.)

MARKETING THE RAW PRODUCT

Root crops are for the most part marketed without delay to prevent loss in weight by evaporation of a portion of the water content. Growers are paid by the ton for the green root less tare, and it is economy to make delivery before the product shrinks. A wagon fitted with an adjustable hayrack or root rack is used to haul the chicory to the weigh-station along the nearest railroad

FIGURE 11.—Thousands of tons of chicory root ready for the kiln. Delivery is made direct by near-by growers, whereas gondolas bring the roots from the distant weigh-stations. (Courtesy of E. B. Muller and Company.)

(Fig. 10.) Some growers use trucks to market their crop in record time. The roots are weighed and tared at the station before loading on gondolas for shipment to the dry kilns. If railway cars are not available in sufficient numbers, and generally they are not because of the great demand created by the sugar beet industry at the same time, the roots are placed in a large heap near the railroad. By dumping the roots in a huge pile the danger of loss by freezing and thawing is lessened for delayed shipments. This practice is also followed upon delivery at the kiln (Fig. 11).

DISTRIBUTION OF DRY KILNS AND FINISHING PLANTS IN RELATION TO PRODUCTION AND THE MARKET

Dry kilns are located at strategic points within the region where plenty of raw material, water, and coke are available. Chicory is grown as far as 20 miles from the dryer. Chicory root is a heavy bulky commodity containing a high percentage of nonessential water (75–78 per cent), and, therefore, cannot be economically transported long distances until the water content is eliminated. Eight kilns are in operation in the Michigan region. E. B. Muller and Company of Port Huron, Michigan, own a kiln at Mt. Pleasant, Bay City, Bad Axe, and Port Huron. H. Franck and Sons of Flushing, N. Y., operate a dryer at Midland, Pinconning, Kawkawlin, and Bay City. These kilns dry 95 per cent of the chicory produced in the United States (Fig. 1).

The source of raw material is not so essential in the location of the finishing plants. After the water is evaporated, the only waste material remaining in the chicory is ligneous fiber which is rather light in weight and limited in amount. Hence, dry chicory can be shipped much cheaper than the green root, so the position of the market centers is more important in the location of the finishing plants. Then, too, during lean years of domestic production of raw chicory, the dry root is imported from Europe, and good importing facilities are an advantage. The Port Huron finishing plant has a large market in the coffee roasting centers of New Orleans, Detroit, and Chicago; and the cereal coffee substitute manu-

facturing plants throughout northeastern United States; as well as the advantage of closeness to raw material of superior quality. H. Franck and Sons of Flushing, New York, are

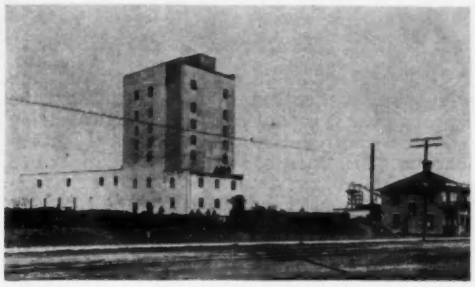

FIGURE 12.—A general view of a dry kiln where the water content (75–78 per cent of weight) is removed by evaporation. Coke-heated ovens surround the huge chimney in the taller portion of the building. Ample storage space in the rear wing is provided for the dried root to await shipment to the distant finishing plants as needed. Moisture is a nonessential at the dryer. (Courtesy of E. B. Muller and Company.)

favored by the eastern markets and ideal importing facilities during lean years of domestic culture. Less than 7 per cent of the raw chicory consumed at the finishing plants in 1928 was imported from Belgium and to a lesser degree from Holland, Germany, France, and Czechoslovakia.

PREPARATION OF CHICORY FOR CONSUMPTION AS A BEVERAGE MATERIAL

The dry kiln performs the first step in the manufacturing process. Drying begins with the first delivery of roots by the grower and ends in the late fall or early winter. Chicory is first washed thoroughly and then carried in flumes to the slicer where the roots are cut into pieces the size of a hen's egg. The dryer is a fireproof building of 6 to 10 stories with coke ovens surrounding a large chimney (Fig. 12). Pieces of chicory are spread in the ovens to eliminate all the water content. From 45 to 90 tons of green root are dried by kilns of varying capacity in 24 hours. A large dry storage space is provided for the dried root to await carload shipment to the finishing plant. In the drying process the pieces of root shrink and lose most of their weight. Four to 4¼ tons are required to make 1 ton of dry root. Dry chicory is a light bulky commodity and is shipped to the finishing plants in box cars. Although drying is a seasonal function, there is little difficulty in securing the few laborers necessary to operate the kiln.

The finishing plant completes the process of manufacture (Fig. 13). A chicory factory, together with the dry kilns, represents an investment of approximately $1,000,000. About

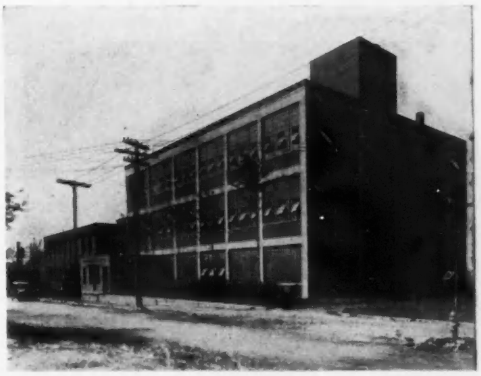

FIGURE 13.—Finishing plant of E. B. Muller and Company at Port Huron, Michigan. About $1,000,000 is invested in this plant and equipment which manufactures granulated, stick, and powdered chicory. Light, air, and moisture are quite essential in the finishing plant. (Courtesy of E. B. Muller and Company.)

twice this amount is invested in buildings and equipment for the preparation of chicory in the United States. Unlike the beet sugar plants, the chicory factories operate throughout the year with maximum economy in capital costs per service rendered. Costly large scale machinery, especially devised for chicory manufac-

ture, adds to the capital investment of this relatively small but important industry (Fig. 14). During the finishing process the dry chicory is cleaned, roasted, crushed to a powder, the ligneous fiber separated and discarded, granulated by the introduction of moisture, sized, and packed in sacks and barrels for shipment (Fig. 15). All of this work is done by specialized machinery most of which cannot be used in any other industry. One exception is the machine for removing the ligneous fiber, which was designed primarily for removing oats from wheat. By adapting this machine to chicory manufacturing, all roots can be utilized regardless of the amount of ligneous fiber growth resulting from adverse climatic, drainage, soil, or cultural conditions.

Granulated chicory is identical in appearance and color to ground coffee (Fig. 16). It is manufactured in different grades and color to match the grades of coffee with which it is to be blended. A considerable quantity is also packed in the powder and stick forms. Finished chicory is handled with great care on account of its tendency to reabsorb moisture. Consequently, all jute sacks, boxes, and barrels used for packing are lined with moisture-proof fiber paper to guarantee safety from deterioration (Fig. 17). E. B. Muller and Company of Port Huron utilizes between 15,000 and 16,000 tons of green root in the annual manufacture of about 6,500,000 pounds of finished chicory. H. Franck and Sons produce about the same amount.

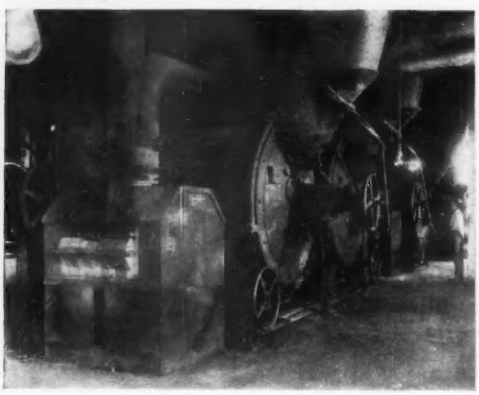

FIGURE 14.—Interior view of a portion of the finishing plant, showing a battery of roasters. Most of the machinery in the factory is especially designed for chicory manufacturing and is imported from Europe. (Courtesy of A. Van Slandrouck.)

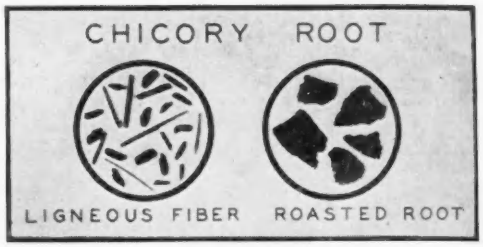

FIGURE 15.—The pieces of chicory root are roasted to a coffee brown. After crushing, the ligneous fiber is separated by grooved revolving disks, and discarded as waste material. Ligneous fiber resembles oats, so the machine designed to remove oats from wheat was adopted for separating the ligneous fiber from crushed chicory. The growth of ligneous fiber in the root due to abnormal physical conditions or seeding is no longer a serious menace to the manufacturer. (Courtesy of A. Van Slandrouck.)

CHICORY MARKET

Domestic chicory is utilized by coffee roasters, cereal coffee substitute manufacturers, and wholesale grocers within the United States. In 1928, the United States utilized 14,500,000 pounds of which 13,400,000 were domestic production, and 1,100,000 were imported from Europe. About 65 per cent of the domestic product is granulated chicory marketed in New Orleans and New York, as well as other minor coffee-roasting centers throughout the United States where a small coffee business is supplying the local trade. Light-colored coffee beans are blended and im-

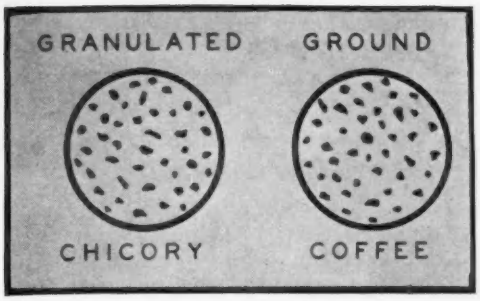

FIGURE 16.—Granulated chicory and ground coffee are identical in appearance. Granulated chicory is manufactured in several grades to match the different grades of coffee, and is used most extensively by the New Orleans and New York coffee roasters.

proved in quality with chicory to make "French Market Coffee" and other brands which are sold to the hotel and restaurant trade in many parts of the world. Brands containing chicory are so labeled to meet the requirements of the Pure Food Law. The remaining 35 per cent of the chicory output consists of stick and powdered products which are purchased by the grocery trade for addition to coffee brew in the home. Also, a small percentage is used by the cereal coffee substitute manufacturers. Chicory imparts the coffee flavor and deep amber color to cereal coffee substitute.

TARIFF DEMANDS OF PRODUCER AND CONSUMER

Tariff regulations in the chicory industry form the basis for much debate between producers and buyers. It was pointed out at the beginning that the chicory industry of America was born and developed under a protective tariff for infant industries. The supporters of the industry contend that any attempt to eliminate a reasonable tax on imported refined chicory is against the best interests of the producer. It is further claimed that the Government should protect the interests of the American producer so long as statistical proof is given to show that the industry is suffering from foreign competition. On the other hand, the buyers of chicory demand a low tariff to enable them to purchase cheaper goods under keen foreign competition.

Under the present tariff rates of 1½ cents per pound on the dried root and 3 cents per pound on finished chicory, the manufacturers and growers appear strained according to statistical data, and have asked the 71st Congress to revise the tariff schedule. In testimony before the Senate Ways and Means Committee recently, it was brought out that domestic granulated chicory is selling in New Orleans at 8¼ cents per pound. Foreign manufacturers are

FIGURE 17.—Interior view of the E. B. Muller and Company warehouse at Port Huron, Michigan. Finished chicory is shipped in jute bags, or in barrels, which are lined with a moisture-proof fiber to prevent the reabsorption of moisture. After the drying process, chicory must be continually protected from the damp climate of the Great Lakes Region in order to avoid deterioration. (Courtesy of A. Van Slandrouck.)

selling at 7.3 cents per pound in the same market. Granulated chicory imports increased from 104,273 pounds in 1922 to 1,100,000 pounds in 1928 with a very small advance in consumption. Domestic chicory

is superior in quality and coffee roasters buy the foreign product only when they can secure it at a lower cost. Cheaper labor in Belgium and Holland, where growers pay $1.00 per day for male and $0.50 for female labor, so lowers the cost of production that Europeans sell in New Orleans at a lower cost than the United States manufacturers, after adding tariff, insurance, depreciation, and extra freight charges. In 1928 the Michigan acreage was reduced from 9,000 to 8,000 acres, and the contract price to growers from $16 to $11 per ton because of the foreign importations. Although the coffee roasters are obtaining a cheaper chicory, the American growers and producers are suffering a business depression.

From the foregoing facts, it appears that the Michigan growers and the United States manufacturers of chicory are justified in their demands for a duty of 4 cents per pound on imported manufactured chicory and a low tariff on the dry root. A higher tax on manufactured chicory would eliminate some of the foreign importation and restore the American plants to a normal capacity output. On the other hand, a low tariff on raw chicory makes it possible for the manufacturers to purchase the dry root from Belgium and Holland during lean years of domestic culture, in order to operate at normal capacity and supply our own market demands. Growers would benefit by a higher tax and a larger acreage would be planted. Since chicory manufacturers depend largely on other industries to create a demand for their product, the acreage and price has to be fixed by contract with the grower before the growing season, making adequate protection most desirable.

CONCLUSIONS

The future of chicory production in the United States depends for the most part on the regulation by Congress of a legitimate tariff rate on both imported dry root and manufactured chicory. In view of ample lands with satisfactory physical conditions, Michigan alone could produce enough raw chicory to supply the world, but in recent years there has been a decline in the output. The intensive nature of cultivation tends to absorb much unemployment of our industrial centers. The dependence on the coffee-roasting and cereal coffee substitute industries in which the United States leads the world, and the principle of protection for infant industries upon which the cultivation and manufacture of chicory was constructed, provide a legitimate basis for the establishment of adequate government protection. Should the Congress and President of the United States accede to tariff demands of the growers and manufacturers, the chicory business of the Wolverine State will regain its former status and prosperity. Otherwise, production will undoubtedly continue to decline in the presence of the annually increasing importation from foreign fields.

BOOK REVIEWS

DEPARTMENT OF COMMERCE

Bureau of Foreign and Domestic Commerce

Foreign Trade of United States in Fiscal Year 1929–1930. Trade Information Bulletin No. 718.*

Foodstuffs. San Francisco Restaurant Industry. Price, 5 cents.

Study of the restaurants of San Francisco, showing the number in operation, amount of investment, character of equipment, number of employees and payroll, seating capacity of the various establishments, average annual sales, relation of wages of employees to sales made, average amount of customer's check, and length of time each restaurant has been operated under same management.

Iron and Steel. Czechoslovak Iron and Steel Industry. Trade Information Bulletin No. 713.

Far Eastern Markets for Dairy Equipment and Supplies. Trade Information Bulletin No. 711.

Latin American Markets for Dairy Equipment and Supplies. Trade Information Bulletin No. 710.

Market for Industrial Machinery in British South Africa. Trade Information Bulletin No. 717.

Markets for Sawmill and Woodworking Machinery in Central and Eastern Europe. Trade Information Bulletin No. 709.

Markets for Sawmill and Woodworking Machinery in Western Europe. Trade Information Bulletin No. 715.

Market for Cooking and Heating Appliances in Canada and Latin America. Trade Information Bulletin No. 714.

Handbook of Foreign Tariffs and Import Regulations on Agricultural Products. III—Canned Foods in the Western Hemisphere. By Roberta P. Wakefield and Robert S. Hollingshead. Trade Promotion Series No. 97. Price, 50 cents.

The Western Hemisphere constitutes an important market for exported American foods. More than 17 million dollars' worth of these products was shipped to countries of North, Central, and South America in 1929, making up more than 22 per cent of the total exports of canned foods from the United States in that year.

* The cost of all Trade Information Bulletins is 10 cents.

To assist American producers and exporters of foodstuffs to plan their foreign business in the light of the duties and regulations of other countries, and to help them to avoid customs and sanitary difficulties abroad, this third in the series of tariff handbooks on agricultural products has been prepared.

British Market for Domestic Electrical Appliances. Trade Information Bulletin No. 730.

Electrical Equipment Market of Netherland East Indies. Trade Information Bulletin No. 727.

Apparent Per Capital Consumption of Principal Foodstuffs in United States. By E. G. Montgomery and C. H. Kardell. Domestic Commerce Series No. 38.

The object of this publication is to bring together in one place such data as are available on per capita consumption of foodstuffs in the United States.

United Kingdom: An Industrial, Commercial, and Financial Handbook. By Hugh Butler, trade commissioner, and officers of Departments of Commerce and State. Trade Promotion Series No. 94. Price, $1.75.

This study contains 953 pages, 81 illustrations, and 6 maps prepared by the Geographic Section. It deals with general factors in British industry and trade, labor conditions and living costs, conditions in various industries, status of agriculture, overseas trade, transportation and communications facilities, banking and trade financing, taxation of business, insurance, foreign investments and public finance, commercial laws, and distribution channels for merchandise. There is a chapter on northern Ireland and a bibliography.

Trading Under the Laws of Peru. By Roger D. Moore and Joaquin Servera. Trade Promotion Series No. 98. Price, 25 cents.

This booklet has been prepared as a general reference manual containing information of a legal nature pertinent to business problems of frequent occurrence in Peruvian trade. For the business man, it will provide a background in the formulation of executive and sales policy.

Ocean Routes in United States Foreign Trade. By A. Lane Cricher. Trade Promotion Series No. 96. Price, 10 cents.

This bulletin makes a survey of our ocean trade routes to and from foreign countries.

The Coffee Industry in Brazil. By Walter Gay McCreery and Mary L. Bynum. Trade Promotion Series No. 92. Price, 20 cents.

Brazil furnishes from two-thirds to three-fourths of the coffee produced throughout the world, and 50 per cent of the coffee moving out from Brazilian ports is destined for the United States alone. It is believed that this study will be of interest, not only to those firms actively engaged in the coffee business, but also to students and organizations interested in Latin-American affairs generally.

Handbook of Foreign Currency and Exchange. By James R. Mood. Trade Promotion Series No. 102. Price, 30 cents.

The purpose of this monograph is to furnish economists, bankers, business firms, and men in the foreign field with a brief history of world currency conditions and recent legislation, together with such average exchange rates as are available since 1900. The practical usefulness of a study of this character, covering 115 countries, is obvious.

The Automotive Market in Chile. By Howard H. Tewksbury. Trade Promotion Series No. 107. Price, 15 cents.

American-made cars account for approximately 95 per cent of the number of automobiles exported to Chile. The Government of Chile has long realized the importance of highways in economic development, and their program for road construction will probably be completed within a short time, thus giving Chile a complete system of first-class highways connecting the principal centers of the country. This bulletin contains maps of Northern and Southern Chile automotive sales areas, which were prepared by the Geographic Section, showing cities of primary and secondary importance.

Travel Routes and Costs in Latin America. Trade Promotion Series No. 100. Price, 15 cents.

The increased travel, resulting as it has in closer coöperation between the producer and the merchant, has accounted in part for the steady and relatively unbroken progress that has been made in past years in the extension of the commercial activities carried on between the nations of this hemisphere. Until recently, the tourists of this country gave practically no consideration to South America as a destination. This bulletin contains those facts which should enable an exporter or commercial traveler to outline quickly and accurately an itinerary covering those countries. Two maps were prepared by the Geographic Section for this bulletin. One is of the Caribbean Area and the other is of South America, showing the important cities.

The Automotive Market in Brazil. By Howard H. Tewksbury. Trade Promotion Series No. 106. Price, 25 cents.

Rail transportation is possible only in the most thickly populated sections of Brazil and far-distant sparsely populated sections, with vast unexploited resources, must rely largely on the automobile for transportation services. Today, fairly good highway systems serve the more thickly populated sections and more roads are being constructed, for the country appreciates the effect of more highways on its future prosperity. This bulletin contains maps of Northern and Southern Brazil Automotive Sales Areas, which were prepared by the Geographic Section, showing major and minor sales areas.

International Trade in Leather. By J. Schnitzer. Trade Promotion Series No. 103. Price, 45 cents.

Handbook on American Underwriting of Foreign Securities. By Ralph A. Young. Trade Promotion Series No. 104. Price, 25 cents.

American Direct Investments in Foreign Countries. Trade Information Bulletin No. 731.

Statistical Abstract of the United States, 1930. By Martha Hunter, and others. Price, $1.00.

This volume represents a digest of data collected by all statistical agencies of the National Government, as well as those of a considerable number of private agencies and several States. It contains chapters on area and population; defectives, delinquents, and dependents; vital statistics; immigration and emigration; education; public lands and national parks; climate of selected cities in the United States; Army, Navy, Civil Service, Pensions, Veterans' Bureau activities and elections; National Government finances; state, city, and local government finances; money and banking; foreign commerce; and commerce of noncontiguous territory.

Leather Industry and Trade of Czechoslovakia. By Julius Schnitzer. Trade Information Bulletin No. 732.

The Brazilian Market for Belting. By Rudolf E. Cahn. Trade Information Bulletin No. 729.

Annual Report of the Director of the Bureau of Foreign and Domestic Commerce to the Secretary of Commerce for the Fiscal Year ended June 30, 1930. Price, 10 cents.

Marketing American Leather in China. By Harold D. Robison. Trade Information Bulletin No. 728.

Italian Chemical Developments in 1928 and 1929. By Elizabeth Humes. Trade Information Bulletin No. 705.

Airports in Canada and Newfoundland. By Laurence E. Ring. Trade Information Bulletin No. 716.

The Automotive Market in Paraguay. By Howard H. Tewksbury. Trade Information Bulletin No. 720.

Cuban Readjustment to Current Economic Forces. By Frederick Todd. Trade Information Bulletin No. 725.

Airports in Italy. By Laurence E. Ring. Trade Information Bulletin No. 721.

French Chemical Industry and Trade in 1929. Trade Information Bulletin No. 726.

Australian Canned Fruit Industry. By E. C. Squire. Trade Information Bulletin No. 703.

Canned Grapefruit Production and Trade. By C. E. Birgfield. Trade Information Bulletin No. 706.

National Retail Credit Survey. Part I. Domestic Commerce Series No. 33.

Foreign Trade of the United States in the Calendar Year 1929. By Grace A. Witherow. Trade Information Bulletin No. 684.

Finland: An Economic Review. By Alvin C. Eichholz and Herbert Rodeck. Trade Information Bulletin No. 681.

This study aims to review the basic economic conditions of Finland in such a way as to give a clear appreciation of the present status and the future possibilities, particularly in their bearing on international trade. The Geographic Section prepared a map of Finland for this bulletin, on which they give the official Finnish spellings together with the Swedish equivalents.

Airports in Latin America. By Brower V. York. Trade Information Bulletin No. 696.

National Retail Credit Survey. Part II. Domestic Commerce Series No. 34.

Financial Developments in Latin America During 1929. By Eugene W. Chevraux. Trade Information Bulletin No. 707.

Markets for Fruit Juices and Fruit Sirups in the Pacific Countries. By S. R. Peabody. Trade Information Bulletin No. 704.

Motion Pictures in China. Trade Information Bulletin No. 722.

Market in Burma for Imported Foodstuffs. By George J. Haering. Trade Information Bulletin No. 724.

HELEN M. STRONG

KEARTON, CHERRY. *In the Land of the Lion.* xix and 291 pp.; ills., and index. National Travel Club, New York, 1929.

"In the Land of the Lion" is a book by a man who understands animals, by a pioneer in big game photography who was with Roosevelt in Africa. The author is a man who has spent his time in the bush learning to know its inhabitants as few hunters trouble to do, and his understanding account of these familiar, yet little known, animals gives us a picture of the Dark Continent such as is not often caught with either brush or pen.

Mr. Kearton speaks of the animals; he does not write about them. He sees their personalities, and in whimsical phrases makes us see them, too, as we should see our friends or our enemies. To each of the more conspicuous ones, he devotes a chapter, telling informally of their lives as he has observed them, and of incidents that occurred when they came in contact with human beings.

He likes the lion; he fears the elephant; he dislikes the crocodile. He finds it "impossible to feel anything but affection for the hippo," whom he "can only regard with good-tempered amusement." In the days before the rhino had been nearly exterminated he "spent his time largely in climbing trees to get out of their way." The leopard is a killer; the hyena "is, among other things, a murderer, a thief, a bully, and a coward"; the giraffe is "graceful" and "stately," despite the fact that "to those who do not know him he is rather a subject for merriment." The snake, the ant, birds, and "creatures great and small" all receive some mention.

Throughout the book, particularly in his accounts of the larger animals, we realize the author's feelings for his subjects, and lament with him that man is fast driving these creatures off the earth.

PRISCILLA H. WEBSTER

Conference of Empire Meteorologists, 1929. Agricultural Section. Three parts: I. Report, 16 pp., 3 appendices; II. Papers and Discussions, 308 pp., 51 tables, 13 diagrams and illustrations, 6 bibliographies; III. British Agricultural Schemes—Observers' Handbook, 34 pp., 6 diagrams and illustrations, 14 Forms for Recording Meteorological and Agricultural Data. Printed under the authority of His Majesty's Stationery Office, by Wyman & Sons, Ltd., Fetter Lanes, London, E. C. 4. Price, 1s. net. Post free. 9⅝ by 6⅛ inches.

These reports present a very good portrayal of the Agricultural Section of the Conference of Empire Meteorologists which was held in London, August 29, 30, and September 4, 1929. Sir Napier Shaw, F.R.S., presided.

Part I, Report, is principally a summary of the Proceedings of the Conference. The subjects discussed were grouped under the following heads:

Joint Sessions:

- General Climatology
- Seasonal Forecasting

Agricultural Sessions:

- Historical Review of the Subject
- A Weekly Calendar
- Weather and Crop Growth
- Measurement of Daylight
- Meteorological Research and Fruit Production
- Climate and Animal Distribution
- Weather and Insects
- Weather and Fungous Diseases of Plants
- Use of Meteorological Data in the Improvement of Crop Estimates

A full list of the papers submitted for discussion in the Agricultural Section with their authors is listed in Appendix C.

The conference of meteorologists and agriculturists discussed the scope and methods of agricultural meteorology and agreed that "Agricultural Meteorology is concerned with the effects of climate and weather on agricultural processes" —and that—"The search for the influences of meteorological conditions in agriculture is carried out under four main heads: (a) Soils, (b) Crops, (c) Animals, (d) Pests and Diseases of Crops and Animals."

Resolutions were adopted concerning instruction in meteorology and agricultural meteorology, experimental and demonstrational work in agriculture, and other subjects brought forth in the papers and discussions. Details of the above are discussed in this report. In addition, Appendix A contains a list of Overseas Delegates and Observers to the Agricultural Section of the Conference of Empire Meteorologists, 1929. Appendix B shows a list of Representatives from England, Wales, Scotland, and Northern Ireland.

Part II, Papers and Discussions, presents in detail the reports and their discussions. The scope of subjects is wide and varied. The first article, "Agricultural Meteorology; A Brief Historical Review," is the interesting opening address given by Sir Napier Shaw, F.R.S., Chairman.

"Agricultural Meteorology in Its Plant Physiological Relationships" by V. H. Blackman, Sc.D., F.R.S., of the Research Institute of Plant Physiology, Imperial College of Science and Technology, and "The Varietal Responses of the Plant to the Length of Day" by M. A. Tincker, M.Sc., Royal Horticultural Society's Gardens, Wisley, show the correlation between the intensity of climatic factors and the growth of plants especially in relation to light and the length of day. An excellent bibliography of recent investigations on photoperiodism (length of day) accompanies the second article.

Dr. F. J. Martin, Agricultural Chemist, Agricultural Department, Freetown, Sierra Leone, discusses the existing relationships of the climate, crops, and soils of British Tropical Colonies in his article, "Climate, Crops and Soils in British Tropical Colonies."

The most technical report is "Methods for the Photo-Electric and Photo-Chemical Measurement of Daylight" by W. R. G. Atkins, Head of the Department of General Physiology, Marine Biological Laboratory, Plymouth, and H. H. Poole, Registrar, Royal Dublin Society. The methods used are illustrated by photographs and diagrams and are discussed especially in relation to vegetation. A good bibliography is included. Some effects of the weather on fruit production with special reference to the apple are the objectives in "Meteorological Research and Fruit Production" by H. V. Taylor, V.R.C.S.

"The most important complex factor exerting very great influence both on the activities and on the development of insects is the evaporating power of air, which depends on the temperature, humidity, air movement and atmospheric pressure," states B. V. Uvarov (Senior Assistant, Imperial Bureau of Entomology) in his report, "Weather and Climate in Their Relation to Insects." References on the subject of relation of meteorological factors to insects is included.

In one of the most complete reports, "The Relation of Weather to Plant Diseases" by C. E. Foister, B.A., Plant Pathological Division, Department of Agriculture, Scotland, the author has outlined briefly the relation of weather to plant diseases, and has suggested methods by which the meteorologists can be of assistance to the plant physiologists. The discussion is limited to diseases caused by fungi and micro-organisms. A bibliography of 305 references of relatively recent works is given.

A good bibliography and an excellent review of the methods in use and scientific work in the relation between weather and crops, and on crop forecasting from weather in various countries is given in "Crop Forecasting and the Use of Meteorological Data in Its Improvement" by J. O. Irwin, M.A., M.Sc., Rothamsted Experimental Station. He also discusses the value of crop forecasts as related to crop insurance, value to trade and administration, and its future in Great Britain.

Among other papers are "Ten Points of a Weekly Calendar," "Weather and Tobacco," "The Relation of Animal Number to Climate," "The Relation of Entomology to Meteorology," and "Crop and Weather Data in India and Their Statistical Treatment."

Part III, The British Agricultural Meteorological Scheme—Observers' Handbook has been prepared for the use of the agricultural meteorological observer. The schemes and topics discussed are best shown by the contents which include (I) Aims and Methods; (II) Meteorological Observations; (III) Agricultural Observations; (IV) Horticultural Crop Observations; (V) Phenological Observations; (VI) Summary of Monthly Diaries; (VII) The Agricultural Committee and Its Sub-Committees; (VIII) List of Agricultural Meteorological Stations. The Appendix consists of fourteen forms for recording meteorological and agricultural data.

The Conference Reports are interesting and generally authentic. Students and readers of the natural sciences, especially plant geography, plant physiology, ecology, and meteorology will find information and sources of data which are most recent in them.

ESTHER S. ANDERSON

COMMISSION DE METEOROLOGIE AGRICOLE—Organisation Meteorologique Internationale. Procès-Verbaus de la Ème Réunion. Copenhagen, 1929. 101 pages, 4 illustrations, 9 tables, a list of members and location of each of the "Commission de Meteorologie Agricole, September, 1929." Kurgl. Boktryckeriet. P. A. Norstedt & Sons, Stockholm, 1929. Price, 2:50 kroner.

The Commission of Meteorological Agriculture Convention was held from September 9 to 15, 1929, at Copenhagen. This was similar to the Conference of Empire Meteorologists which was held at London. The Meteorologie Agricole, however, includes representatives from all parts of the world.

Proceedings of the meeting, reports, and discussions (the major number written in French, some in German, and a few in English) are given in the bulletin. Summaries of the first and second conventions held in 1927 and 1928 are also included. Mr. Axel Wallén, Director of the Meteorological and Hydrographical Service, Stockholm, was president and Professor Wilhelm Schmidt, High School of Agriculture, Vienna, served as secretary.

The first part of the report contains summaries of the business and reports together with letters which were exchanged between the presidents of the Commission of Meteorologie and l'Institut International d'Agriculture for the establishment of coöperative work in meteorological and ecological agriculture.

Dr. Napier Shaw of London presented his paper, "The Week as a Phenological Unit," which was given also at the Empire Congress. Some of the members believe that the month is the unit which should be used, but Dr. Shaw thinks the week is better for meteorological work. His reasons are well discussed in this article.

Professor Holdefleiss discusses the relation of weather conditions to harvest and growth of plants in his article, "Uber die Abhangigheit der Ernteertrage von der Wettergestaltun." Six correlations and a bibliography are listed at the close of the paper.

A summary (written in French) of various questions for consideration by the International Commission of Meteorological Agriculture at the meetings include:

1. Relations and collaborations with the Commission of Meteorological and Ecological Agriculture of the International Institute of Agriculture.
2. Resolutions of the Commission of the International Institute of Agriculture including (1) report for the observations and methods in meteorological agriculture; (2) studies in different climatic localities; (3) actinometric observations.
3. International Bulletin.
4. Questionnaire concerning the organization of the meteorological agricultural service.
5. Proposition of Sir Napier Shaw on the week as a phenological unit.
6. Study of temperature of the air near the surface of the earth. This article is long. Details with illustrations showing the methods of placing the weather instruments and instructions of how to use them are fully described.
7. Evaporation.
8. International Agrometeorological Study.

The relation of production of cereals, olives, and grapes, to seasonal distribution of rainfall in Spain is discussed by Mr. Meseguer in this article, "Sur les productions agricoles espagnoles en leurs relations avec le distribution de precipitation aqueuse dans les saisons de l'année 1927. Tables showing important areas and production of cereals, oils, and wines are included.

In the long article, "Bestimmung der relation Frosthärte bei Pflanzenvarietäten durch künstlich hervorgerufene Kälte," Dr. Åkerman, Director of the Botanical Institute at Svalöf, Sweden, discusses the resistance to cold of various plants such as red clover, needle grass, and especially wheat as determined experimentally by using artificial cold temperatures. He also gives natural habitat conditions which have been studied in these experiments. They are trying to develop varieties of wheat which are resistant to cold and also to plant diseases and lodging. Five tables showing varieties of wheat used, temperatures, and some of the results are included.

The report contains many other interesting and valuable articles by eminent scientists. This summary is a good reference. The list of the members of the Meteorological Agricultural Commission gives the names and the locations of the principal workers in this field and may be used as sources for further information.

ESTHER S. ANDERSON

DUDDY, EDWARD A. *Agriculture in the Chicago Region*. University of Chicago Social Studies No. XV. x and 158 pp., 56 full-page maps, 10 diagrams, 11 tables. University of Chicago Press, 1929.

The conception of the problem, as outlined in the introduction, is intimately connected with the major problem of regional planning. "Regional planning is the attempt to direct the forces of economic competition for the use of land in the region about a city. . . . In this keen competition (for land) what remains for agriculture and food supply? What should remain? What will be the probable future status of agriculture in such a region?"

The author considers only the first of these three questions, although there are included some brief introductory generalizations by R. H. Engle to the effect that rising land values will intensify agriculture. The study avowedly "aims at giving a picture of the use of the land in the Chicago Region for agricultural purposes at the time when 1925 census of agriculture was taken by the Bureau of Census."

The work is divided into six parts: a statement of physical conditions and a long statistical appendix which together make up half the book, and four parts which are entitled "The Use of the Land," "The Crops," "Live Stock," and "The Farms" and "The People."

In setting up the physical background, only two maps have been employed: one, a map of the

physiographic divisions of the region according to Fryxell, with heavy lines delineating the areas producing cattle, corn, oats, and butter; the other, a soil map compiled from the five sources which cover parts of the area. The soils given different names on different maps were correlated by transects in the field and for the map in this volume were grouped as "dark upland, light upland, dark lowland, light lowland, sand, gravel, mixed bottom, peat muck marsh."

The physiographic divisions are briefly described and the major crops of each noted. Soils receive a more detailed treatment in which the author is much more at home. Throughout the book, soil is the only physical factor correlated with crops. The brief presentation of climate is awkward and adds little to the discussion.

The use of the land is portrayed by maps of per cent of land in farms, crops, pasture, and other than crops or pasture, based upon township data supplied by the Bureau of Census. In addition, there is a pie graph of land use for the region and segmented bar graphs for each county.

Corn, wheat, oats, barley, hay, white potatoes, sugar beets, vegetables, apples, other tree fruits, grapes, and strawberries are the subjects of dot maps of distribution and, except the last three, hatched map of production per acre. The live stock dot maps are devoted primarily to the dairy industry. The maps of the last series show the number of farms, size, value of land, buildings and implements, mortgage debt, tenancy, total and per acre farm population.

The maps are cartographically excellent with a single exception (No. 2). Their arrangement, however, is not so well done. In no case where there are pairs of maps, such as oats acreage—oats production per acre, or chickens—eggs, were the maps on opposite pages, though this could easily have been accomplished by slight changes in order.

The volume is of value to geographers in that it provides relatively inaccessible basic data for a significant study or studies in agricultural geography. The survey aimed to secure the facts of distribution, which it did well and thoroughly, and to give a picture of land use. To a geographer this presupposes field investigation, to the end that correlated facts may be mutually interpretive rather than merely coincident.

MEREDITH F. BURRILL

WEBER, ALFRED. *Theory of the Location of Industries.* 252 pp. Edited, translated, introduced, and annotated by C. J. Friedrich. University of Chicago Press, Chicago, 1929.

Theory of Location of Industries is a trail-blazing venture, for it attempts to master by theoretical analysis "a complete wilderness of facts" concerning the location of industries, and it seeks to reduce these factors to a mathematical formula. Weber is the first to attempt so labyrinthine a task. Till now, the greater part of the research dealing with the reasons for the location of industries has been done by economic geographers and not by economists. But, they were concerned essentially with specific industries in specific localities; they also were concerned almost entirely with the rôle of the natural environment upon the location of manufactures. Hence, their researches were quite unsatisfactory to economists.

While Weber's work is by far the most comprehensive and original ever attempted, it will be disappointing to the great majority of geographers, who will find it too theoretical.

LANGDON WHITE

LUFFT, HERMANN. *Das Britische Weltreich.* 622 pp.; maps, illustrations, bibliography, index. Bibliographisches Institut A. G., Leipzig, 1930. 32 Reichsmark.

LUFFT, HERMANN. *Latein-Amerika.* 484 pp.; maps, illustrations, bibliography, index. Bibliographisches Institut A. G., Leipzig, 1930. 28 Reichsmark.

VON ECKARDT, HANS. *Russland.* 568 pp.; maps, illustrations, bibliography, index. Bibliographisches Institut A. G., Leipzig, 1930. 30 Reichsmark.

Cable and radio, fast steamers and faster aeroplanes are competing in a desperate effort to decimate, if not to annihilate, distance. International and intercontinental trade, therefore, should increase; national economics and politics are subjected to a growing pressure of world-wide forces. Realizing this, a leading German publishing house is doing its share toward developing a cosmopolitan mentality, a world psyche based on sound knowledge and wise understanding of the earth as it is today. Under the general title of *Provinzen der Weltwirtschaft und Weltpolitik*, which freely translated into English means something like areas of world economy and politics, this firm is publishing six volumes which divide the world as follows: Europe, the British Empire, Anglo-America, Latin-America, Russia, and East Asia. Of these, three are available now and the others are expected to appear in the near future.

These books are not easily classified. They are more factual than books of the type with which we have become acquainted through Siegfried, Zimmern, Haushofer, and others; on the other hand, they are more analytical and speculative than most studies which have come from the pen of economic geographers. The political side is stressed and a philosophical strain runs through the entire series which is definitely addressed to a mature, educated, and intelligent public.

It is a fortunate circumstance that the three books of the series which have come out so far

deal with areas of the earth which at present are attracting more than ordinary attention. The recent Empire Conference has moved the general problems of the British Empire into the limelight; while the India Conference is lending added importance to what is perhaps the gravest empire problem. Revolutions, which in rapid succession have broken out in diverse corners of South America, have again focused the attention of students of world economy on that continent, and the Five-Year Plan of Soviet Russia is demanding the most earnest consideration of every serious student of world affairs.

It must seem remarkable that two such important volumes as those treating of the British Empire and of Latin America should be written by the same author. Few people will aspire to that ambitious task of writing expertly on two such widely different and so important provinces of world economy and politics. Yet, whatever misgivings one may have felt concerning the ability of one man to treat with equal authority of these two areas is dispelled as one penetrates into the depth of these two volumes.

Dr. Hermann Lufft, the author of these two volumes, has spent considerable time "abroad," mainly in the Western Hemisphere. To American readers, he is known as the author of valuable contributions to the *Weltwirtschaftliche Archiv*, particularly of a most stimulating study of the external economic relations of the United States. Possessing a broad liberal education, a thorough training in commerce and economics, but above all, a clear and open mind, Dr. Lufft could benefit from his "Lehr-und Wanderjahre" more than the average globe trotter. Observing and assimilating the new and the strange to this author is a passion. Moreover, his power to synthesize the seemingly unrelated, to discover the grains of basic worth in a mountain of trash is a task which Dr. Lufft approaches with an ability so extraordinary that it borders on genius. Like Stuart Chase, Dr. Lufft is an accountant by profession, and like his American colleague he combines the willingness to undertake painstaking research with the ability to soar like an eagle.

To the Usamerican—to apply a phrase which, according to Lufft, has been adopted in Europe as a simplified term describing an inhabitant of the United States of North America—the delimitation of Latin America must seem somewhat strange. We are used to including Cuba and Porto Rico. These regions are entirely left out of the picture. In the same way many readers will be surprised to find that in the volume on the British Empire almost sixty pages are devoted to Australia and New Zealand, while Canada has to be satisfied with only twenty pages. However, these apparent flaws are easily explained by the division of the earth into the six provinces of world economy and politics. Undoubtedly, Cuba, Porto Rico, and Canada will be treated much more fully in the volume on Anglo-America. Whatever criticism one may wish to raise, therefore, would have to be directed against the editor of the entire series rather than against the author of individual volumes.

The general layout of the two volumes written by Dr. Lufft is as follows: a general part treating major geographical, historical, social, economic, and political aspects serves as an introduction to a special part devoted to individual countries or areas, while another general part, a sort of grand finale, summing up major lines of thought, brings up the rear. In the book on Latin America, the general parts cover eighty and fourteen pages, respectively, while in the volume on the British Empire the introductory part covers twenty-four pages and the finale fifty-four. There is a decided difference, however, between the summaries of the two volumes. In the book of the British Empire, a real synthesis, an attempt to treat of the Empire as a living organism, is given. On the other hand, no such organic interrelation exists between the republics of Latin America, and hence, in that case, the summary is devoted to an appraisal of the relative strength of the centripetal and centrifugal forces.

The volumes, as the title given to the entire series implies, stress economic and political aspects. These, however, are treated not only from a European standpoint, but also as they appear to the country under discussion. Latin America is thus viewed not merely as a fertile field for European or North American business, but also as an active participant in the future development of world economy. The same treatment is applied to the British Empire.

Statistical data in both volumes generally reach down to or even through 1928. The text, however, takes cognizance of even later developments. Occasional remarks refer to events which took place in the spring of 1930. Value figures, in the Latin American volume, are given in United States dollars, a fact which is not without special interest to the reader in this country.

The American reader will note with understanding, but also not without regret, an omission which, in the opinion of the reviewer, detracts considerably from the value of the volume on Latin America. Reference is made to the systematic treatment of the part played by foreign capital in the economic development of that continent. One will be inclined to agree with the author that an exhaustive treatment of that phase would require a separate volume of considerable size. Yet, so all-important seems the question of capitalistic penetration with all its actual and potential effects and repercussions on lender and borrower alike that one can hardly help feeling disappointed over the consistent neglect of this part of the problem. As a market, Latin America is as yet relatively unimportant; based on United States per capita purchasing power the population of Latin America represents an equivalent of probably less than 10,000,000 people. Its significance as a field for investment would,

therefore, gain in relative importance. However, the author has so much to offer even to the specialist in world economics and in international relations that it is hardly necessary to emphasize this feature of the work.

Undoubtedly, on many issues such as the Gandhi movement, the problem of Australian economics and the appraisal of the vitality of the Empire idea, one may hold opinions different from those expressed by the author; yet one can always be sure to find a wealth of stimulating ideas on any topic which Dr. Lufft chooses to discuss.

The volume on Russia is written by the head of the Department of Journalism of the University of Heidelberg. Professor von Eckardt for a number of years was connected with the Weltwirtschaftsarchiv of Hamburg and had charge of the Eastern European section of the *Wirtschaftsdienst*. A native of Russia, who studied at Moscow, the author possesses more than ordinary advantages as an interpreter of the country about which he is writing.

To the average American who tends to emphasize the immediate influences of environment rather than the more subtle forces which lurk in the background of the past, and who, therefore, is inclined to look upon Soviet Russia as a radical departure from all previous history, it must seem strange to see fully half of the 525 pages of this book on Russia devoted to history. Yet, the more one ponders about the great economic and social experiment which is being carried on in Russia today, one realizes that its success or failure depends to a large extent upon the manner in which present developments fit into that complex of institutions which is the product of a thousand years of Russian history. A study of that history reveals the surprising fact that unique as the Five-Year Plan may appear, it nevertheless contains elements which strongly resemble social and economic experiments which have been tried in Russia in czarist days.

Moreover, as time goes on it becomes increasingly more evident that the success of the Russian experiment hinges upon the human qualities of the Russian people. It is a question of how much patience the peasants possess, how much common sense they bring to the new tasks and to what extent collectivistic thinking fits into his general mental make-up. Unfortunately, pre-Revolutionary Russian literature had largely confined itself to discussing the problems and traits of the upper ten per cent—made up partly of the ruling class associated with the czarist régime, partly of a neurotic and indecisive intelligentsia—and had practically left out of the picture the very ninety per cent whom Lenin tried to make the real carriers of modern Russian history. The study of Russian history, therefore, becomes almost the only means by which that appraisal of racial and national psyche and character can be made without which some of the most momentous questions facing the student of modern Russia cannot be answered. If we learn, for instance, that the Russian masses are not wholly made up of the subject races which during centuries of serfdom lost whatever initiative may once have been their natural inheritance, but also of considerable elements absorbed from the conquering tribes, especially the Tatars —Lenin is said to have had Tatar blood in his veins—the reactions of these people to present-day experiments must necessarily be very different.

Having acquired the necessary historical perspective, the reader approaches with better understanding the second half of the book, which is devoted to the discussion of modern Russia. It is interesting to note that Professor von Eckardt chooses to discuss Russian geography only after he has given this very thorough historical introduction. His argument is that the same environment will exercise different influences according to the prevailing institutional pattern and according to the economic problems facing a particular generation. The discussion of the Soviet Régime is marked by remarkable judiciousness. On the one hand, no effort is made to disguise the brutality of the Soviet Régime or to belittle the difficulties under which it is laboring; on the other hand, every effort is made to give credit where credit is due. No one who knows anything about the nature of the present experiment going on in Soviet Russia will expect for a moment from an author a ready answer to the question: "Whither Russia?" But he can expect such information and interpretation as will enable him better to appraise the trends and forces at work. Of that, the reader receives a goodly share in this remarkable book on Russia.

ERICH W. ZIMMERMAN

ANNOUNCEMENT

THE series on the *Agricultural Regions of the World* will be resumed in the April, 1931, issue with the first instalment of *Agricultural Regions of Asia* by Dr. Samuel Van Valkenburg of the College of the City of Detroit. Another instalment of *Agricultural Regions of North America* by Dr. O. E. Baker may also appear in the April issue. This will be followed in a later issue by *Agricultural Regions of Africa* by Homer L. Shantz, President of the University of Arizona, and will complete the finest geographic discussion of the world's agriculture thus far published.

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